The Engineering and Mining Journal

Volume 101, No. 22
Issued Every Saturday
Hill Publishing Company

NEW YORK, MAY 27, 1916

Price, 15 Cents
Contents, First Page
Advertising Index, Last Page

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ANNOUNCEMENT

WORTHINGTON PUMP AND MACHINERY CORPORATION

announce that it has taken over all the properties and assets of

INTERNATIONAL STEAM PUMP COMPANY

Snow Steam Pump Plant, . . .	Buffalo, N. Y.
Deane Steam Pump Plant, . . .	Holyoke, Mass.
Laidlaw-Dunn-Gordon Plant, . . .	Cincinnati, Ohio
Blake & Knowles Steam Pump Works,	East Cambridge, Mass.
Power & Mining Machinery Co., ...	Cudahy, Wis.
International Gas Engine Company, ...	Cudahy, Wis.
Fred M. Prescott Steam Pump Co., ...	Milwaukee, Wis.
Jeanesville Iron Works Company, ...	Hazleton, Pa.

and will act as Sales Agent for HENRY R. WORTHINGTON, whose operation will be under the direction of the Worthington Pump and Machinery Corporation.

This opportunity is taken to express to the purchasing public the most cordial appreciation of past favors and support, and to bespeak for the Corporation the same courtesies and consideration heretofore extended to the above companies and plants.

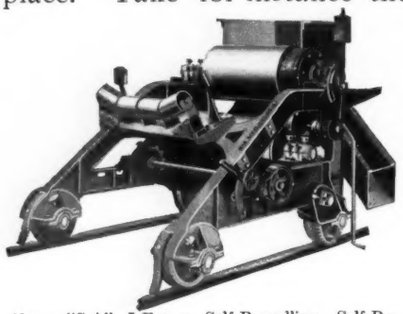
April 24, 1916

The S-A Page

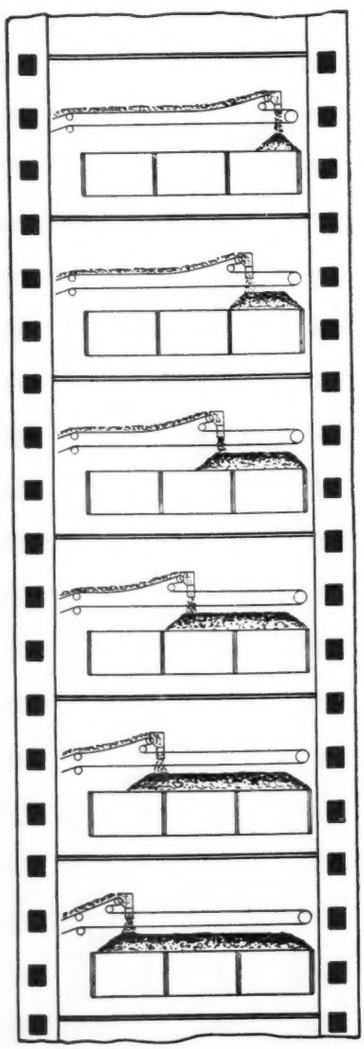
Published Weekly in the Interests of S-A Conveying Engineering

"Distributing Ore to Bins"

The Superiority of "S-A" Belt Conveyors lies not only in correct design, but in the use of the right equipment in the right place. Take for instance the Shuttle Conveyor and the Tripper. In many cases where a Tripper has been specified we have changed the design to permit the use of a Shuttle Conveyor, at a large saving, both in installation and operating cost.



Above—"S-A" I-Frame Self-Propelling, Self-Reversing Tripper, one of the heaviest and most substantial of our standard types.
Below—"Movie" of Tripper in operation.



No definite rules can be given to determine when one should be used and when the other, and this is where the experience and judgment of the "S-A" Engineers is found of value.

The two "films" show the operating principles of both. Notice that the length of Shuttle Conveyor required, is approximately half the length of the bins served. With a tripper, however, the conveyor must extend the entire length of the bins. Also the weight of the Shuttle Conveyor may be distributed, while the Tripper places a concentrated load upon the supporting structure; and what is sometimes important the Shuttle requires less headroom than the Tripper.

The "S-A" engineers are prepared to cooperate with you in the design and installation of complete ore handling plants. Their many years of specialization in this line is placed entirely at your disposal without obligation.

Bulletins and full particulars in regard to your special problem, gladly furnished on request. Write.

Stephens-Adamson Manufacturing Co.

Conveying, Screening, Transmission Machinery

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Branch Offices: New York, Chicago, Boston, Pittsburgh, St. Louis, Huntington, W. Va., Detroit, Salt Lake City, Toronto, Canada,

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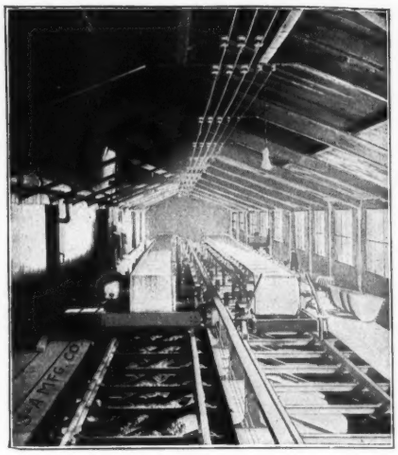
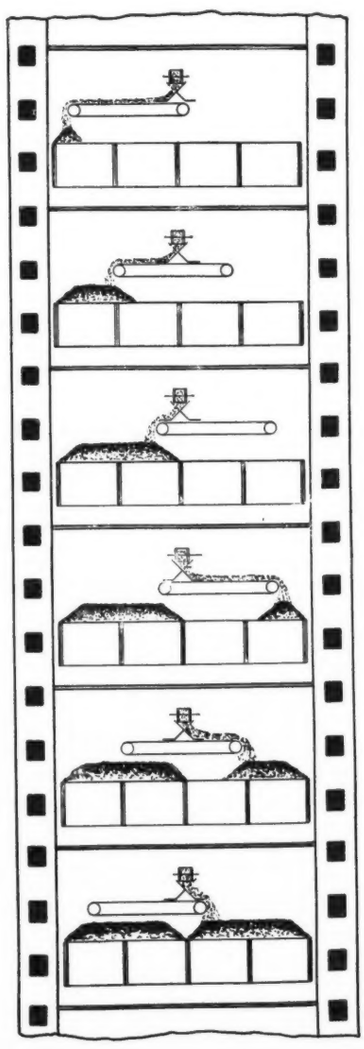


Above—Two "S-A" Shuttle Type Belt Conveyors above ore bins.
Below—"Movie" of Shuttle Conveyor in operation.



Mining Journal

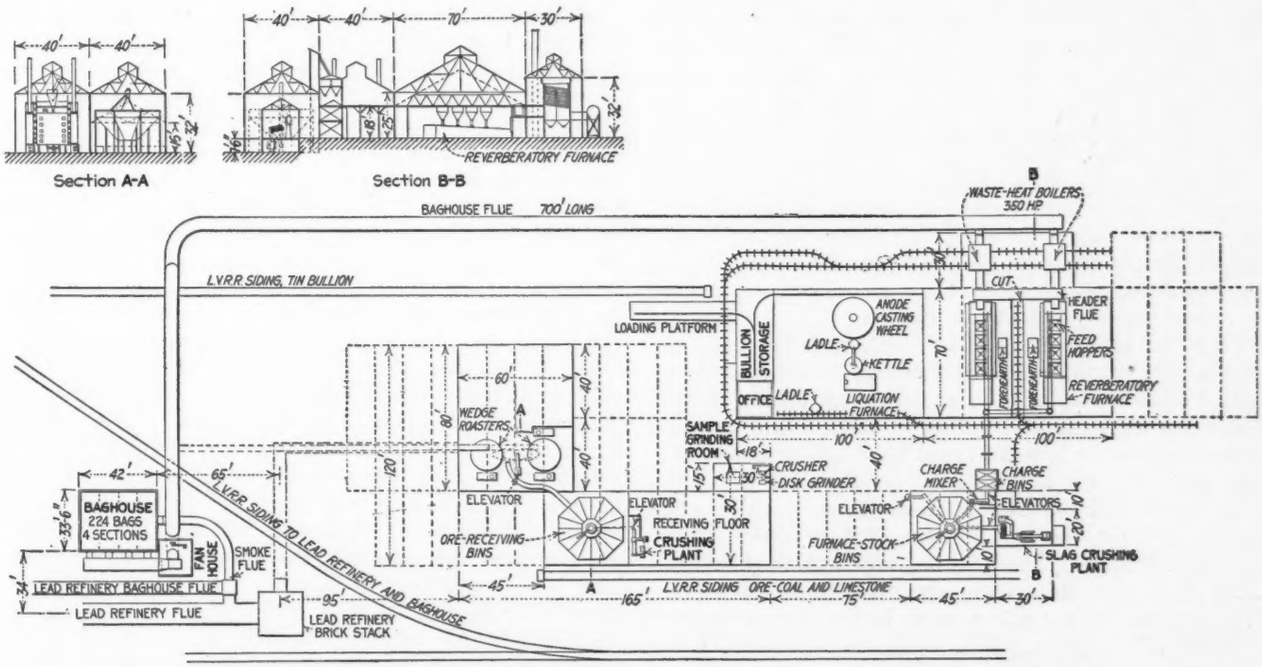
VOLUME 101 MAY 27, 1916 NUMBER 22

Tin Smelting at Perth Amboy, N. J.

By Richard H. Vail

SYNOPSIS—The new tin-smelting plant of the American Smelting and Refining Co. produced its first crude tin on Mar. 7, from Bolivian concentrates, and marks the beginning of important reciprocal relations between the United States and Bolivia. Regular practice is followed in smelting at Perth Amboy, but the crude tin will be refined electrolytically—a departure in tin metallurgy.

The Americas—chiefly Bolivia—mine about 20% of the world's tin and use—principally the United States—about 45% of the world's output. It is fitting, therefore, that the tin mined in America should be smelted in America. Though there have been some previous attempts at tin smelting in the United States, for one reason or another they have been short-lived and unfruitful. The American Smelting and Refining Co., has just started its new tin smeltery under conditions which promise for this industry, new to the United States, a happier history than the past .



LAYOUT OF TIN-SMELTING WORKS OF AMERICAN SMELTING AND REFINING CO.

This new tin-smelting plant is at Maurer (Perth Amboy), N. J., and is housed in a series of steel-and-hollow-tile buildings near the electrolytic-copper refinery of the Perth Amboy works. The first crude tin was made at the new plant on Mar. 7 from Bolivian concentrates and at the time of the writer's visit was being cast into anodes, preparatory to the starting of the electrolytic refinery when a sufficient accumulation was at hand. As the refining of the Bolivian crude tin on a commercial scale by the electrolytic process is something of a departure in the metallurgy of tin, this department has to work out many features of the practice as it goes along. The smelting department, however, is proceeding along established lines and is in charge of an experienced tin smelter, E. V. Pearce, formerly with Williams, Harvey & Co., Ltd. Mr. Pearce was, so to speak, raised in the tin industry, his father having been managing director of Williams, Harvey & Co.'s works at Liverpool and Hoyle, where as a boy the younger Pearce spent much of his time, eventually becoming assistant manager. A few years ago Mr. Pearce went to Budapest to establish a tin-smelting works that was to supply the Austro-Hungarian government. His family has for years been intimately connected with the tin-smelting industry, and a cousin is now in charge of the works of Williams, Harvey & Co., at Liverpool.

Briefly, the new tin-smelting plant consists of a receiving and sampling department, two Wedge muffle

roasters, two reverberatory furnaces—of large size as regards the metallurgy of tin—a liquation furnace and casting department to produce the anodes for the electrolytic refinery. This at present comprises 68 tanks placed in one end of the copper refinery, but eventually will probably be placed to the east of the anode-casting building.

Tin smelting, speaking generally, is a small high-grade operation. The ores or concentrates, after being unloaded at the docks, are delivered into a sampling room provided with a concrete floor. The ores are received in sacks, and on account of the value of the material, great care is taken in the handling. The tin shipments are made in small lots, and the sampling is usually done by taking each tenth sack as a representative sample of the lot, following in this respect the established traditions of the industry. In the sampling department a crusher and set of rolls is provided for the purpose of crushing any ore that does not happen to be in fine condition. Most of the material to be smelted, however, is already in exceedingly fine condition, consisting of concentrates. After having been sampled, the ores are elevated by a steel-housed bucket elevator to the main receiving bin.

Polygonal Storage Bins Inclosed in Building

On account of the high value of the material, there are some unusual features in the receiving department. The receiving bin, built in an inclosed portion of the plant, is itself entirely inclosed and has the section of a 16-sided polygon with the lower portion in the form of a frustum of an inverted pyramid. The bin, built throughout of steel construction, is hung from near the top of the receiving room and contains 16 compartments, delivering through a series of 8-in. pipes ranged approximately in a circle at the small end of the inverted pyramid. Under the center of the bin is a turntable and platform scale, over which the charge car is placed. Canvas pipe, connecting the steel-pipe discharge of the various compartments, enables the operator to draw into the charge car any ingredients desired.

When the charge mixture is ready, it is trammed to the roasting room, where the charge is dumped into another steel-housed elevator that delivers to one of two Wedge five-hearth muffle roasting furnaces, where the ores or concentrates are given a sweet roast. The muffles are fired with fuel oil atomized by air supplied at about 24-oz. pressure by a No. 5 Roots blower, which also supplies air for the oil burners of the reverberatory smelting furnaces. The roasting and smelting departments have two units each, one furnace in each case being intended as a spare so as to insure the continuous operation of the plant. The Wedge furnaces are 16 ft. in diameter and roast to a practically dead roast about 35 tons of tin concentrates in 24 hr., but this tonnage can be exceeded when desired.

The roasted ore is trammed in small charge cars to the furnace-stock room in which is suspended another 16-sided bin, similar to the one receiving the crude ore. Platform scales are installed on a turntable underneath the bin as in the crude-ore storage department, and the contents of the furnace-stock bin can be drawn into charge cars, just as the roast charges were made up. In the stock bin are compartments containing limerock and anthracite crushed to ⅛ in., so that the necessary lime for flux and the anthracite required for reduction may be drawn directly into the charge cars containing the calcines. The completed charges are dumped into a mixer and thence elevated to a small storage bin placed at a suitable height to fill, by gravity, charge cars running on a track over the reverberatory-furnace hoppers; the charge is further mixed on being drawn from the hoppers into the reverberatory furnace, and on being spread therein with hand rabbles.

Reverberatories of Large Size for Tin Smelting

The reverberatory furnaces, two in number, are about 12x38 ft. (inside) and are among the largest tin-smelting furnaces in existence, most tin furnaces of earlier construction having capacities varying from one to five tons per charge. The Perth Amboy furnaces are lined with firebrick and have a brick bottom sloping toward the taphole, which is at the side of the furnace, approximately in the center. The furnaces are heavily ironed and have springs at the ends of the tie rods for the purpose of adjusting the roof tension when the furnaceman happens to overlook this important feature.

Each reverberatory furnace is provided with two oil burners, the oil being atomized by air supplied at about 24-oz. pressure, as in the case of the roaster burners. There are four charge hoppers along the center line of the furnace; the charges are dropped through charge holes in the roof at intervals of 9 to 10 hr. The charge normally consists of 15 tons, containing about 12 tons of calcines and the necessary amount of crushed limerock and coal. It is highly desirable to reduce to a minimum the amount of slag produced, as this has to be re-treated on account of its high tin content. When the charge melts, ebullition takes place on the production of carbon monoxide and the reduction of the tin oxide. The furnace does not require much attention, but after four or five hours, is stirred by hand rabbles to assist in getting the coal that may be unconsumed mixed with the molten charge. When the evolution of the gases has ceased, the charge is usually ready to be tapped. On opening the bay at one side of the furnace, the molten charge flows into a two-compartment forehearth. This is a low rectangular steel box, 10x4x1 ft. deep, and is lined with firebrick, the brick partition wall having an opening at the bottom. As the metal and slag are both drawn out of the furnace in tapping, the hole at the bottom of the partition is kept plugged at first. When the first compartment is sufficiently filled with metal and slag so that the supernatant slag will not pass through into the other compartment, the plug is opened and the clean metal permitted to collect in the larger compartment. The slag in the first compartment is allowed to overflow and is caught in a pot car running in a depression between the two reverberatory furnaces. The slag is hauled by an electric locomotive to the dump and, after cooling, is broken up and crushed to about ⅛ in. When enough slag has accumulated, a special run is made on this material, and while the first slag may contain from 10 to 25% SnO_2, the final slag discarded from the "slag run" will be about 1 to 1.5 % Sn.

The furnace is tapped as dry as possible and the bay again stopped up with clay, and recharging immediately begins. Three or four charges are usually obtained per 24 hr.; from each of which a tap of about seven tons of metal is obtained.

After cooling for a short time, the metal in the forehearth is tapped into a pot and taken to the anode-casting department. As the pot car containing the molten tin enters the anode-casting department, it goes up a short incline which gives sufficient height to permit delivering the metal into a pouring ladle with three spouts. The metal is cast into shallow molds, placed on trucks, three molds being filled simultaneously. After casting into these molds, the crude tin is charged when convenient into a liquating furnace, from which it drains into an externally fired pot about 6 ft. in diameter. In this pot it is agitated by compressed air—equivalent to the agitation formerly obtained by the old hand method of "tossing"—to remove the dross. This operation may take from one to five hours, and when the dross has been separated and skimmed, the tin is fed by a centrifugal pump into a pouring ladle that delivers into anode molds on a casting wheel of the Walker type. The tin anodes are lifted by a small air hoist and loaded on cars for tramming to the electrolytic-refining department.

The tin-smelting department is designed to operate with a small force of men—three per shift in the roasting department and about six men in the smelting and anode-casting department. The reverberatory furnace during the period of smelting requires but little attention, and the smelting crew attends to the liquating and casting of the crude tin in the anode-casting department. The number of men employed in the receiving department of the smelting plant depends upon the arrival of supplies.

The dust made in the tin plant is carefully collected and recharged. That produced in the roasting furnaces is minimized by the use of muffle furnaces. The reverberatory furnaces make but little dust; the coarsest of this is collected in hoppers underneath the waste-heat boilers installed in the reverberatory flues. The fine dust and gases pass into a 7-ft. steel flue for cooling and thence into a baghouse containing 224 bags, 30 ft. long and 18 in. in diameter.

Refining the Tin Electrolytically

The electrolytic-refining department is the feature of this plant in which a decided departure from standard methods has been instituted, and for a number of months its practice will have to be developed on a working scale, based on the experience obtained in a small pilot plant. The electrolytic refinery comprises at present 68 tanks similar in size and construction to those used for copper refining. The tanks are of wood, lined with an asphaltic coating to resist the electrolyte—mainly hydrofluosilicic acid of about 15% strength, in which is dissolved about 4% of tin. In circulating this electrolyte it is necessary to use hard-rubber fittings, the delivery of which caused some delay in the starting of the electrolytic refinery on a commercial scale. In the Perth Amboy yards, the American Smelting and Refining Co. has a sulphuric-acid plant of about 50 tons' daily capacity, and here it will also make its current requirements of hydrofluosilicic acid, though the initial supply was purchased.

Each tank in the electrolytic refinery will contain about 11,000 lb. of tin anodes. The cathode starting sheets will be of tin about ⅛ in. thick, made by casting in a manner similar to the making of thin lead-cathode sheets. According to the results in the experimental, or pilot, plant, the current density will be about 12 amp. per sq.ft. and the deposition per ampere about double that of copper. The anodes will be in the tanks about 20 days, and the output of the initial plant will be between 15 and 20 tons of electrolytic tin per day. The electrolytic tin produced has averaged from 99.96 to 99.98% fine, or purer than the Straits product. Credit for this achievement is due R. L. Whitehead, superintendent of electrolytic refining at the Perth Amboy plant. The tin will be marketed as "A. S. & R. Co. ELECTROLYTIC." Manufacturers of high-grade tin foil and of tin plates have reported that preliminary trials with this brand gave entirely satisfactory results, no manipulative difficulties being experienced. The company therefore expects the brand to become popular quickly.

Mining Members of Industrial Preparedness Committee

The Committee on Industrial Preparedness, an adjunct of the Naval Consulting Board, which has been referred to before in the *Journal,* has for its chairman Howard E. Coffin, one of the leaders in the country's automobile industry. W S. Gifford, statistician of the American Telephone and Telegraph Co., is supervising director of the work of the committee, which is proceeding to inventory the manufacturing and industrial resources of this country along lines previously described.

This committee is composed of representative members from each one of the five national engineering societies for each state. The members of the American Institute of Mining Engineers who have been appointed on this committee, together with other engineers representing other societies who are closely in touch with or allied to the mining business are:

Alabama—Priestly Toulmin, president, Lehigh Coal Co.

Alaska—Philip R. Bradley, Alaska Treadwell Gold Mining Co.; John Wulzen, Alaska Gold Mines Co.

Arizona—John C. Greenway, general manager, Calumet & Arizona Mining Co.; A. G. McGregor, Calumet & Arizona Mining Co.; David W. Jones, chief electrician, Arizona Copper Co., Ltd.

Arkansas—J. R. Fordyce, president, Thomas Fordyce Manufacturing Co.

California—G. W. Dickie; C. W. Merrill, Merrill Metallurgical Co.

Colorado—D. W. Brunton, T. B. Stearns.

Connecticut—Eli Whitney, president, N. & N. H. Trust Co.

Delaware—Thomas Coleman du Pont; Charles L. Reese, E. I. du Pont de Nemours & Co.

District of Columbia—Hennen Jennings; John H. Finney, Southern manager, Aluminum Co. of America.

Florida—Robert N. Dickman.

Georgia—S. W. McCallie, state geologist.

Idaho—Stanley A. Easton, George F. Waddell.

Illinois—Frederick K. Copeland, president, Sullivan Machinery Co.

Indiana—George P. Hulst, International Lead Refining Co.

Iowa—E. A. Sayre, general manager, Eagle Coal and Mining Co.

Kansas—H. G. Hixon, metallurgist, Prime Western Spelter Co.

Kentucky—Frank D. Rash, vice-president and general manager, St. Bernard Mining Co.

Maine—R. H. Richards, professor mining engineering, Massachusetts Institute of Technology.

Maryland—W. H. Peirce, vice-president and general manager, Baltimore Copper Smelting and Rolling Co.

Massachusetts—W. E. C. Eustis.

Michigan—M. M. Duncan, general manager, Cleveland Cliffs Iron Co.

Minnesota—H. V. Winchell.

Missouri—P. N. Moore.

Montana—J. L. Bruce, manager, Butte & Superior Copper Co.; Eugene Carroll, vice-president and general manager, Butte Water Co.; C. V. Nordberg, Nordberg Manufacturing Co.;

E. P. Mathewson, manager, Washoe Reduction Works, Anaconda Copper Mining Co.

Nebraska—Walter T. Page, manager, Omaha plant, American Smelting and Refining Co.

Nevada—W. E. Trent, Trent Engineering Co.

New Hampshire—H. R. Batcheller.

New Jersey—B. F. Cresson, Jr., chief engineer, N. J. State Board of Commerce and Navigation.

New Mexico—Stephen O. Andros.

New York—Charles F. Rand, Spanish-American Iron Co.

North Carolina—Joseph H. Pratt, state geologist.

Ohio—Charles S. Robinson, second vice-president, Youngstown Sheet and Tube Co.

Oklahoma—M. M. Valerius, Valerius, McNutt & Hughes.

Oregon—A. M. Swartley, Bureau Mines and Geology.

Pennsylvania—Vance C. McCormick, publisher, trustee for estates.

Rhode Island—Walter M. Saunders, Saunders & Franklin.

South Carolina—H. L. Scaife, lawyer and manager of mining companies.

South Dakota—Allan J. Clark, metallurgist, Homestake Mining Co.

Tennessee—A. A. Blow, president, Carolina Copper Co.

Texas—Arthur J. McQuatters.

Utah—Lafayette Hanchett, director, National Copper Bank and Bankers Trust Co.; William Wraith, general manager, International Smelting Co.; William C. Ebaugh, consulting chemist, U. S. Smelting Co.

Vermont—C. B. Hollis, general superintendent, Eastern Talc Co.

Virginia—Frank U. Humbert, manager of mines, Low Moore Mining Co.

Washington—J. C. Ralston, vice-president, Pacific Coast Pipe Co.

West Virginia—I. C. White, state geologist.

Wisconsin—F. W. O'Neill, sales manager, Nordberg Manufacturing Co.

Wyoming—W. D. Waltman, general manager, Franco-Wyoming Oil Co.

Duty to Safeguard Setscrews

By A. L. H. Street*

Suit by one who had been employed as jigman and shift boss in a concentrating mill, brought to recover damages for injuries sustained through his clothing becoming caught by a projecting setscrew on a revolving pulley on a lineshaft in the mill, recently afforded occasion for a decision by the Supreme Court of Utah concerning the liability of employers for accidents of this kind, as affected by questions of contributory negligence and assumption of risk. (Ockey vs. Bingham-New Haven Copper and Gold Mining Co., 154 Pacific Reporter, 586.)

Plaintiff was injured in the manner indicated while attempting to replace a belt on a pulley in defendant's mill, and when he sued to recover damages on the theory that the injury was attributable to the mining company's negligence, the company pleaded contributory negligence and assumption of the risk as a defense, as well as its own freedom from actionable carelessness. The trial court, sustaining the defense, dismissed the suit, but the Supreme Court reversed the order on plaintiff's appeal.

The principal points decided by the higher court are that it is usually the province of the jury in such cases to determine whether an employer has been guilty of negligence in permitting a projecting setscrew to remain unguarded, according to what ordinary prudence demands considering the location of the screw and other particular circumstances; and that plaintiff was not guilty of contributory negligence and did not assume the risk of the accident, it appearing that all the other setscrews on the shaft were countersunk and that he reasonably assumed this one was, and it further appearing that the setscrew was not observable while in motion and that plaintiff's duties did not require him to make such inspection of the machinery as would have disclosed the dangerous condition to him in the exercise of ordinary care.

*Attorney at law, 829 Security Building, Minneapolis, Minn.

Valuation of Oil Properties

By Dorsey Hager*

How many oil men ever take time to consider the earning capacity of an oil lease or to analyze production conditions? In buying production it is customary to base the estimates on net production or the total production of a lease less the royalty. For the purpose of illustration a lease in Oaklahoma, one year old, having 20 wells on it, is selected as a unit. This lease averaged 20 bbl. per well per day when purchased. Expected performance

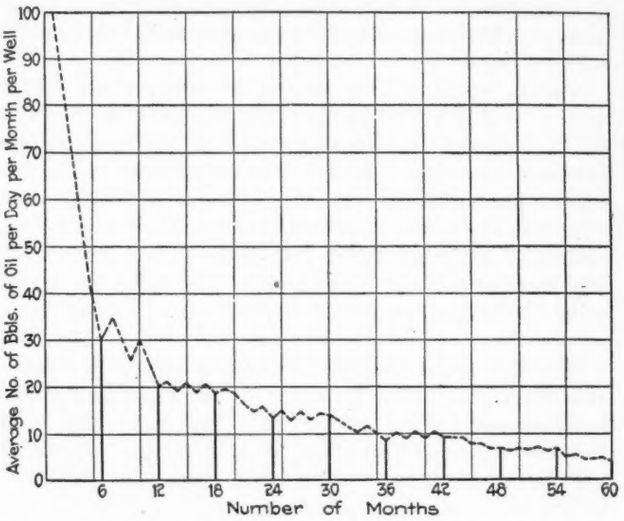


CHART RECORD OF OIL PRODUCTION

of the wells is based upon the accompanying graphic chart, which gives the production line for a period of five years. Table 1 gives the production by months and by years.

TABLE 1. OIL PRODUCTION

Bbl.	Month	Days	Production 20 Wells—Bbl.	
100	First	30	60,000	
85	Second	30	51,000	
70	Third	30	42,000	
55	Fourth	30	33,000	
40	Fifth	30	24,000	
30	Sixth	30	18,000	
35	Seventh	30	21,000	
30	Eighth	30	18,000	
25	Ninth	30	15,000	
30	Tenth	30	18,000	
25	Eleventh	30	15,000	
20	Twelfth, first year	30	12,000	327,000 first year
20	6 months	180	72,000	
15	6 months	180	54,000	126,000 second year
15	6 months	180	54,000	
10	6 months	180	36,000	90,000 third year
10	6 months	180	36,000	
7½	6 months	180	27,000	63,000 fourth year
7½	6 months	180	27,000	
5	6 months, fifth year	180	18,000	45,000 fifth year

The value of oil, $1 per bbl. for a four-year period, is high. Granted however, that the conditions named are fair, let us see how much profit one can obtain from such an oil property.

The items to be considered in accounting for the expenditures are: (1) Initial payment; (2) the interest on the initial payment; (3) the operating costs and (4)

*Petroleum geologist and engineer, 211-12 Lynch Building, Tulsa, Okla.

all taxes and insurance. The items to be considered in the receipts are: (1) The value of the oil produced and (2) the value of the interest on the oil produced. The total profit is, of course, the total receipts less the total expenditures. The yearly profit is the total profit divided by the number of years the investment runs.

The gross production of the lease is 400 bbl. per day. The gross production, less 1/8 royalty, is 350 bbl. Therefore, at $500 per bbl. of daily capacity, the total initial payment is (supposing it is all paid at once) $500 × 350 = $175,000.

In figuring profit, salvage must be taken into account. It amounts to the value of the casing and pipe on the lease, powers, gas engine, jacks, etc. Place such a valuation at $500 per well for wells 2,000 ft. deep, then the total will amount to $500 × 20 = $10,000. This amount is to be subtracted from the original investment in considering the matter of total expenditures. The interest at 8% for 4 yr. is $175,000 × 0.32 = $56,000. The salvage does not enter into this interest consideration.

The operating cost is composed of the following items: Salary for pumper, expenses of book-keeper and for superintendence, besides repairs to power unit, engine, etc. It totals $500 per month, or $6,000 per yr. Therefore, for 4 yr. the operating cost is $6,000 × 4 = $24,000. Some will consider this allowance too high, but when figuring on paying responsible men it is a fair estimate.

Under taxes we consider the gross production tax of 2%, an income tax of, roughly, 1%, fire insurance and workingman's compensation, etc., 1%. A liberal estimate will be 4%, which we will base arbitrarily upon the gross production of the lease. A detailed accounting would perhaps make it 1% more or less. To obtain this 4% allowance, one must consider the value of the annual production (see Table 2 column 3) and multiply that by 0.04.

TABLE 2. ESTIMATION OF VALUE

1		2	3	4
		Value	Less 1/8 Royalty	Less $6,000 Field Expense
327,000	First 12 months.....	Not considered in the settled production		
126,000	Second 12 months.....	$126,000	$110,250	$104,250
90,000	Third 12 months.....	90,000	78,750	72,750
63,000	Fourth 12 months.....	63,000	55,130	49,130
45,000	Fifth 12 months.....	45,000	39,375	23,375
		$324,000	$283,505	

The value of oil less the royalty is $283,505. The income tax, insurance, etc., are as follows:

First Year	Second Year	Third Year	Fourth Year	
$110,250	$78,750	$55,130	$39,375	$4,410.00
0.04	0.04	0.04	0.04	3,150.00
				2,205.20
$4,410.00	$3,150.00	$2,205.20	$1,575.00	1,575.00
				$11,340.20

Total taxes $11,340.20

Total Expenditures:

Initial investment	$175,000
Interest 4 yr. at 8%.....	56,000
Operating cost $6,000 per yr.....	24,000
Taxes and insurance.....	11,340
	$266,340

The value of the oil produced in the four years is the total production of the lease for that period which, as shown in column 2, Table 2, amounts to $324,000. The royalty is 1/8, so the value of the oil to the man who secures the lease is $283,505. To this must be added the interest on the oil produced.

At the value of $1 per bbl. the production is worth $283,505. Part of this production money has been carrying interest, for the money will of course be invested, so that the interest received must be added to the actual cash sales of the oil. In such case the dividends are assumed to be paid annually. If paid semiannually or quarterly the money will of course draw more interest. However, if the money received from production is put at compound interest, it is necessary to figure the initial investment at compound interest, which will offset the interest on the oil value. This complicates matters too much for an illustrative example, so simple interest has been chosen.

The total dividends will bear 4% interest while accumulating and, if reinvested in good securities, will bring 8%. So the dividends are computed on that basis. Also the field expense will bear bank interest, which we put at 2% for 4 yr., as the expense goes on four years. The total interest is then as shown below. The value of the interest on the oil is shown in Table 3.

TABLE 3. INTEREST TABLE

Amount	Rate		
$104,250	@4% for 6 months	$104,250 × 0.02 =	$22,085.00
104,250	@8% for 3 years	104,250 × 0.24 =	25,020.00
72,750	@4% for 6 months	72,750 × 0.02 =	1,455.00
72,750	@8% for 2 years	72,750 × 0.16 =	11,640.00
49,130	@4% for 6 months	49,130 × 0.02 =	482.60
49,130	@8% for 1 year	49,130 × 0.08 =	3,930.40
33,375	@4% for 6 months	33,375 × 0.02 =	667.50
6,000	@2% for 4 years	6,000 × 0.08 =	480.00
			$46,260.50

The total receipts will be $283,505, the value of oil and $46,260.50 interest on it, or a total of $329,765.50. The total profit equals the total receipts less the total expenditures, or $329,765.50 — $256,340 = $73,425.50. This is a total of 41% profit, and the average profit per year is 10¼%.

A net profit of but 41% in four years is not large. Of course one has all his money returned and interest at 8%, with an added annual profit of 10¼%. However, there is considerable risk attendant upon such investments, so the margin of profit is not large enough. The price of $500 per bbl. is manifestly too high to be attractive, but $400 per bbl. would allow a fair profit. The same production at $600 per bbl. would be a poor risk, as shown in Examples 1 and 2.

EXAMPLE 1

$400 × 350 = $140,000.....	$140,000
Interest, 4 years at 8%.....	44,800
Operating expense	24,000
Taxes, insurance, etc.....	11,340
Total expenditures	$220,140
Total receipts as before.....	329,760
Total profit	$109,620

Profit on initial investment:

$$\text{Total profit} \ldots \frac{\$109{,}620}{175{,}000} = 72\%$$

Total profit, 72%. Profit per year $= \frac{72}{4} = 18\%$.

EXAMPLE 2

At $600 per bbl. the cost would be the initial investment, 350 × 600 (less $10,000 "junk").....	$200,000
Interest, 4 years at 8%.....	67,200
Taxes, insurance, etc. (as before).....	11,340
Operating expense (as before).....	24,000
Total expenditures	$302,540
The total receipts will be as before.....	329,760
Total loss	$27,220

It must not be assumed that the property has played out at the end of 5 yr., for in numerous instances properties produce for many years after the initial investment has been returned. In such cases a profit of but 2 or 3% on the original investment may be earned. It is, however, manifestly unfair to rate the profits on such a basis. An appraisal of the property and a revaluation is necessary. Such a valuation will be upon the expected production for the remaining life of the wells with due allowance

for all risks. Such revaluations may give a new valuation of but 10% of the initial investment.

It may be best to treat the later profits as percentage upon the price the property would bring at the end of the 4-yr. period that the initial investment has covered. One must consider each field as a unit. The production curve given may hold in one place but not in another. The principle of computation will remain the same.

British Mining Men at the Front

At the twenty-fifth annual general meeting of the Institution of Mining and Metallurgy, at London, May 11, 1916, Walter McDermott made an address in appreciation of the 700 members of the Institution serving in Europe. Since there are a great many men ineligible by reason of nationality and residence and from considerations of health, age or special obligations, the number of 700 represents a high proportion of the available men who could be expected to serve. There have already been 27 decorations conferred, besides a large number of other distinctions won.

Referring to the Royal School of Mines, Mr. McDermott called attention to the fact that 137 are serving out of 151 eligible by nationality. In addition there are eight students doing important munitions work, which would probably be considered just as valuable to the nation as field service. Therefore, there are actually serving in the war 145 out of 151. Of the remaining six, three are ineligible on account of health or of being under age, so there were only three out of 151 left, and doubtless they had sufficient reasons for not serving. Thus nearly 100% of the students, the mining engineers of the future, have recognized the call of their country.

Fatalities and casualties have been heavy, as might be expected from a service giving so many distinctions; 24 Royal School of Mines men have been killed, 27 wounded, and 3 missing, making a total of 54 casualties. Although many are included probably among the number of 700 in the Institution of Mining and Metallurgy referred to, the Royal School of Mines on the whole has 210 of its former students serving.

The speaker called attention particularly to the kindly action of the American members of the Institution resident in London, in sending a cordial New York message of appreciation, accompanied by presents, to fellow members serving in the Royal Engineers tunneling companies.

At the meeting those who were unable to go into active service put their feelings in the form of a motion, in which it was recorded that,

We, members of the Institution of Mining and Metallurgy, present at the annual general meeting of the Institution, desire to record our sense of pride in and of gratitude to the large number of our fellow members who are privileged to serve in His Majesty's forces and in those of the allied nations in the various theaters of war; and in expressing our appreciation of their ability, courage and devotion to duty, of which we have seen so many evidences, we desire to send them greetings and heartfelt wishes for their welfare, and for their speedy return to their civil professions, whose best traditions they are so splendidly maintaining.

The president called attention to the debt owed by the nation to those who had already fallen in battle. He hoped that those who were left would never forget what they owed them. Enemies might kill their bodies, but their undying fame would act as a spur and inspiration to the youth of Britain to carry on their noble work.

Rocky Mountain Club Dinner

A beefsteak dinner was given on May 11, 1916, at the Rocky Mountain Club, New York City, in honor of William B. Thompson, vice-president. The accompanying photograph shows the dinner in progress, many of the participants being well known in the mining world. Among these may be mentioned John Hays Hammond, president of the club; E. Gybbon Spilsbury, Adolph Lewisohn, Karl Eilers, Otto Sussman, P. A. Robbins and William B. Thompson, the last-named, being the guest of honor. The object of the Rocky Mountain Club is to provide an Eastern home for Western men and so promote interchange of ideas and lead to closer relation between the representatives of both sections.

DINNER GIVEN BY THE ROCKY MOUNTAIN CLUB, OF NEW YORK, TO WILLIAM B. THOMPSON, ITS VICE-PRESIDENT

Reading from left to right the guests are: Front row—Samuel Crowther, F. H. Hamilton, G. L. Stone, William B. Thompson, L. R. Palmer, Charles Starek, M. H. De Young, John Hays Hammond, J. C. Montgomery, E. G. Spilsbury, C. F. Rand, Wallace Flint, W. S. Proskey. In the second row are Karl Eilers, E. O. Holter, S. R. Goldman, Joseph Soss, J. S. Qualey, Barnard Powers, L. Steindler, Gordon Williamson and G. O. Eaton

A New Safety Magazine

The initial number of *The Gold Bar,* the official organ of the Treadwell Committee of Safety of the Alaska Treadwell Gold Mining Co., made its appearance Mar. 31. The editors announced their intention to make a "live" magazine of it. We wish them success in the endeavor. Their first issue is a praiseworthy one.

Samples and Their Interpretation

By E. H. Dickenson* and H. J. Volker†

SYNOPSIS—Methods outlined for plotting assay maps and showing value of ore, width and tonnage. Forms for keeping notes and tabulating data to make them permanently accessible.

Granting that anyone who will can easily inform himself on all phases of scientific sampling from the literature extant, there still remains a very important side of the topic that has been but slightly touched on.

In the present article comparatively little will be said on the actual cutting of the sample, the idea being more to indicate the methods of interpreting the results of sampling after they have been obtained and to indicate the conclusions that may be drawn from such data. The subject first taken up will be mine samples taken from the drifts, crosscuts, raises and other workings of the mine as they progress, and how the results may be expressed in tons of ore in sight at a correct value. The question of daily assays of the run of ore as it comes from various parts of the mine will then be taken up, and some of the conclusions that may be based on these assays will be indicated.

The data herewith are based upon actual field and office work and experience in medium- to large-sized copper mines which are roughly of the vein type, where the mineral contents are fairly uniform in distribution, with no very strongly defined walls.

Methods Outlined Constitute Best Usage at Different Mines

In the Sudbury district some of the nickel-copper deposits are of this type, and Alaska also has properties answering to this general description. The methods outlined will not adhere to the practice observed in any one mine, but the best of such usage as has come under our observation will be dealt with.

In order to simplify the discussion, we will assume the examples given are from a small copper mine of the type already referred to, and only the copper in the ore will be considered, it being assumed that the gold and silver are negligible. This may seem to unduly restrict the subject, but the underlying principles are the same and are capable of general application.

Hand sampling alone will be considered, and for that work the proper tools are much the same the world over, the usual single-hand hammer and moil being all that is necessary to detach the sample and either a box or canvas to catch it. Perhaps those who have conscientiously labored over a precious but extremely tough sample and have had it suddenly fly off the wall far from the box held near-by, will hastily vote in favor of a canvas spread on the floor as the best receptacle to catch the sample. With a canvas, however, there is risk of contamination, but this becomes less as the uniformity of the deposit increases. In most instances it would appear as if a box were the better receiver of the two, for even though some of the chips are lost, a clean good sample is assured by this means.

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†94 South Highland Ave., Ossining, N. Y.

The sample interval is another point which judgment and experience must decide. In the Sudbury district a 3-ft. sample taken on both sides of the crosscuts has been observed. This appears to overdo the matter. Any interval or length of sample shorter than necessary wastes time and money. The proper length must depend upon the distribution of the mineral in the deposit. If the ore is uniform in quality, the samples may be longer; if it is spotty, they must be shorter. In the type of deposit under discussion 10 ft. has been found to be very satisfactory as a distance between samples taken across the backs of drifts and a length of 10 ft. for samples when taken along the walls of crosscuts. In raises, owing to the difficulty in getting good samples, it is often good policy to cut the interval in half or to take samples on opposite sides of the raise.

Of course samples always cut across the orebody. If a sample runs suddenly from ore to waste, the ore should be kept separate from the waste.

Whatever weight of sample is decided on, it must be kept uniform. While it is probably true that a 100-lb. sample across a certain length more nearly represents the true value than a 10-lb. sample over the same length, yet ten 10-lb. samples are better than one of 100 lb. In deposits of the type under discussion it appears that a small sample taken from a groove ½ in. deep and 2 in. wide gives an accuracy quite commensurate with the requirements of the case.

Quite as important as fairness in sampling is the correct spotting of each sample. When working across the back of a drift, there is no difficulty encountered, as the distance along the line of the drift from the last mine survey station at once gives the desired position. Along the walls of crosscuts, however, similar practice is very inaccurate and it is best to measure the diagonal distance from the nearest station to the beginning of the first and to the end of the last sample. If there are any intermediate stations, as many other distances may be taken as desired, thus assuring sufficient checks to preclude all chance of error.

Method of Bagging the Sample

Each sample is put into a canvas bag, a tag is dropped into the bag, and it is then tied shut. It is not assumed that there are any interests abroad to salt the samples. If the samples are wet, some difficulty may be had in preserving the legibility of the tag, and if tight folding alone does not accomplish this object, the tag may be inserted into a slit in a soft piece of wood. This scheme will preserve the figures almost indefinitely.

Once the samples have been brought to the office, they are poured into the baking tins and dried by any means available. An ordinary coal stove is very good for this purpose, the pans being laid on the top several tiers deep.

After drying, the ore is crushed, quartered, ground to about 80-mesh, rolled, and assayed by the cyanide method. A small jaw crusher and a rotary pulverizer make a very good outfit for the size reductions, with a Jones riffle for the quartering. The only trouble likely to be experienced with a rotary pulverizer is that the revolving disk in wearing down its babbited bearing, finally no

longer coincides with the stationary plate and a ridge results on one side of the stationary plate, which causes the machine to stick. The Braun planetary pulverizer overcomes this trouble, but in any event the ridge is easily removed with a file. All these machines in the laboratory must be kept clean, and a broad paint brush and hand bellows or compressed air piped in are quite indispensable to prevent unintentional salting.

The interest of the office in the sample starts with the note-taking. The following form of notes gives a very clear record of the position of the sample, kind of rock, etc. The elaborateness of the notes depends upon the requirements of the case.

Mine No. 10 Level No. 2
Working Place No. 7 XC

No.	Length	Cumulative Length	Remarks
1	10	10	Slate and sulphides
2	10	20	Slate and sulphides
..	9	29	Waste, barren slate
3	10	39	Slate and sulphides
4	5	44	Slate and sulphides
..	15	59	Waste, barren slate

Any geological features that it is desired to record should also be entered in the notes. These notes are most convenient in loose-leaf form, which permits of ready filing in the office. In this case only one working place should be entered on a page, and a column should be provided so that the result of the assay may be entered. In column No. 1 the numbers correspond to those on the tags in the sample bags. When waste is encountered, as shown in the last column, it is often found unnecessary to sample it, but the character of the deposit must be well understood to permit of such an omission, since a very unpromising stretch of ground may contain good ore and there is always the possibility that what is too-low-grade to be ore now may be of value later. The right-hand page of the notes is reserved for sketches. All measurements must of course check when scaled on the mine map.

All samples are plotted on the mine maps, and after assay, the value of each is entered beside it.

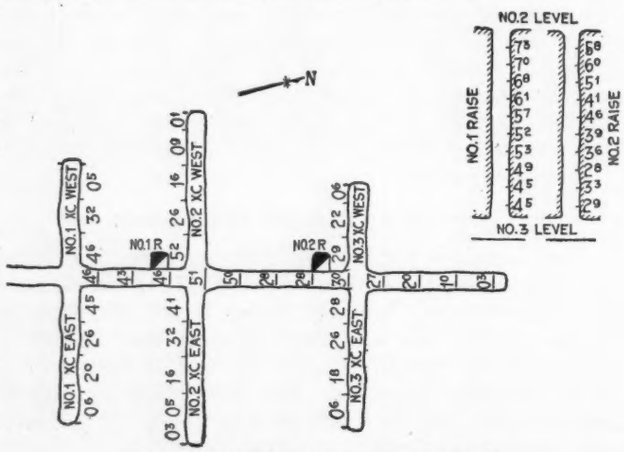


FIG. 1. SAMPLE AND ASSAY PLAN

The accompanying Fig. 1 may represent part of one of the levels of our mine, showing the situation of the samples and their assay value.

Another method of presenting the same information is to show the drifts and crosscuts as single lines and on these to plot the assay values as a curve, so that the length of any ordinate when properly scaled represents the percentage of copper at that point. In the case of a narrow vein its width may be plotted in a similar way on the other side of the center line, or a curve may even be plotted showing the product of these two, so that the length of the ordinate at any point is a measure of the total value of the ore there. Plans of this latter kind are very useful, in that from them one can readily see the relation between the values in the various parts of the orebody. They are seldom made at the small mine, however, where the workings are not so extensive but that the general run of the ore value in the different parts of the mine can readily be carried in the mind.

A plan such as that shown in Fig. 2 gives all the information necessary to answer the all-important question

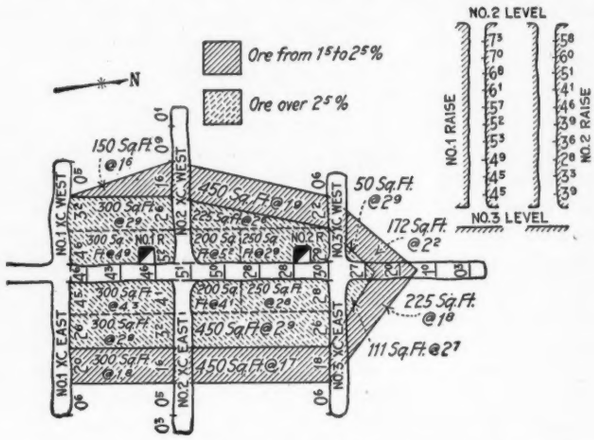


FIG. 2. ASSAY PLAN, SHOWING ORE RESERVES

of the tons of ore in sight and the grade. This statement will be considerably qualified later.

Let us assume that the north side of No. 1 crosscut coincides with some property line and that we wish to estimate the tonnage of ore north of this line between No. 3 level and No. 2 level 60 ft. above.

We will assume also that we wish to consider two grades of ore—first-grade ore over 2½% and second-grade ore from 1½% to 2½%. All under 1½% is considered waste under present conditions.

We first work outward along each crosscut until we reach the point at which the ore falls below 2½%. These points are then connected by straight lines, and the same thing is done for the second-grade ore. We know from our knowledge of this particular orebody that the assays tend to be regular in a north and south direction. We will thus consider each assay in a crosscut as representative of the value of the ore on both sides of that crosscut to a line halfway to the next crosscut, or that the value of the block of ore 10 ft. wide extending from one crosscut to the next is represented by the average of the assays across each end of it. This would be modified if, for example, we had a high assay in one crosscut and a low assay opposite to it in the next and had reason to believe that the higher values did not extend to the center line, but only a short distance beyond the point sampled. The most probable reason for believing this would be the trend of the assays in some near-by drift.

The accompanying figure shows the application of this to the map already given. The areas are best obtained by dividing the figures into triangles and scaling their dimensions. The ordinary planimeter does not give very good results when such large areas are represented on so small a scale. As this work is usually done on a blueprint, the fact must not be overlooked that such prints shrink quite materially and allowance must be

made for this in scaling the dimensions. One method of overcoming this is to lay out an accurate scale on the tracing, thus having each print carry its own scale.

The assays along the drift are taken as representative only of the ore within the area covered by the drift, yet these assays are of the greatest importance, as they give the information from which to judge the proper dividing point between crosscuts. In a similar manner the assays from the raises, although in themselves comparatively unimportant, serve to indicate the manner in which the values vary from one level to the next.

The next step is to tabulate the various areas and their assays and to multiply each area by its assay. The total product is then divided by the total area, and the result is the average assay for the whole. The result in the present example is:

NO. 3 LEVEL NORTH

First-grade ore.....3,366 sq.ft. at 3.51%
Second-grade ore.....1,609 sq.ft. at 2.06%

We will suppose that the same process has been gone through for No. 2 level with the following results:

NO. 2 LEVEL NORTH

First-grade ore.....6,200 sq.ft. at 6.10%
Second-grade ore.....3,100 sq.ft. at 2.00%

We now find the volume of the block between levels by the method of mean end areas and the average value of the ore as follows, considering only first-grade ore:

No. 2 level	6,200 sq.ft.	06.10	Product 37,820
No. 3 level	3,366 sq.ft.	03.51	Product 11,796
	2)9,566	05.14	49,616
Mean Area	4,783		

4,783 sq.ft. x 60 ft. (the distance between levels) = 286,980 cu.ft., which, at 12 cu.ft. per ton = 23,900 tons average 5.14%.

It is assumed in this calculation that the value of the ore varies uniformly from one level to the next, as this is indicated by the assays from the raises. Had this not been the case, it would have been necessary to give the average for each area a weight in proportion to the vertical distance to which it was judged to extend. The volume is found by the method of mean end areas. The estimate of volume is far from exact in any case, and any additional accuracy gained by the use of the prismoidal formula would be largely meticulous.

There remains now, to deduct the volume of ore represented by the drifts, crosscuts and raises, each at its proper assay value.

When there are stopes between levels, deductions must of course be made to cover them. In this connection it is important that the stope surveys be kept up in such a way that cross-sections can be plotted at sufficiently close intervals to permit of ready calculation of their volume. If all the ore is drawn from the stope and records have been kept of the tonnage from each stope and its grade, the problem is a simple one, but if such records have not been kept, the volume must be calculated and a value assigned to it, bearing in mind the assays on the level above, the level below, the manner in which the values vary between levels as indicated by the raise samples and the relative amount of each grade removed as shown by the stope sections. In the case of shrinkage stopes where part of the ore remains in the stope, it is first necessary to assign an assay value to the whole volume of ore represented by the stope and then to deduct the amount that has been withdrawn, thus arriving at the tonnage and grade that remains.

If no records have been kept of the amount of ore and its grade drawn from each stope, the problem of evaluating the ore that remains is a difficult one. For example, if the ore near the bottom of a stope is of better grade than near the top, that remaining will be of lower grade than the original volume of ore whose place it occupies because more of the high-grade ore will have been drawn off from the bottom. For this reason alone, if for no other, it is well to take occasional samples from the back of each stope as it goes up. In choosing the points at which these samples are taken, their purpose should be kept well in mind, as a few samples well-placed may give more information than twice their number of badly placed ones.

Interrelation of Data on Map

It has been said that the map shows all the data necessary to answer the question of tons of ore in sight of a given grade. It does, but the interrelation of these data so as to deduce reliable results requires the exercise of judgment and a knowledge of the trend of assays of the orebody, of horses, barren streaks, faults and of a thousand other considerations that can be gained only by a close study of the orebody and of similar orebodies elsewhere. Once the sampler, the surveyor and the assayer have done their work, the calculation of the ore in sight is far from being a mere matter of arithmetic.

A daily record should be kept in the mine engineering office of the tons of ore drawn from each stope and the grade. The usual method of sampling this ore is to have boxes placed at the mine ore bin or at the loading pocket, marked with the number of the raises, and as each car is dumped, a grab sample is taken from it and placed in the box marked with the number of the raise from which the car has been drawn. The capacity of the car will be known, and the number of cars is best kept track of by the usual tally board. At the beginning of each shift the tally boards are noted and the boxes are emptied and the samples taken to the assay office. This method of sampling is necessarily inaccurate, but in most instances it is the only method available.

The fact, however, that these samples are inaccurate should always be kept in mind when conclusions are based upon them. In this connection it is well at the end of each month to compare the average value of the ore for the month as determined from these samples with the average based on the smeltery or concentrator returns, as in this way a line may be had on the extent to which the grab samples are apt to be in error. Where the ore is spotty and irregular in character, they may vary so greatly as to be almost worthless, while where the ore is more uniform in character, they may be found to be fairly reliable.

The following is a good method of recording these samples, two books being kept. Book No. 2 is most convenient in loose-leaf form. The labor involved in keeping records of this kind is very little, and the information supplied is invaluable. A record of the daily output is of course absolutely necessary from the operating

DAILY OUTPUT—BOOK NO. 1

Date	Raise No.	Stope No.	Tons	Assay	Product	Total Tons For Day	Average Assay	Total Prod. to Date	Total Tons to Date	Average Assay to Date
May 1..	6	2	200	3.1	620	...	....	....	...	..
May 1..	5	2	100	2.7	270	...	....	....	...	..
May 1..	16	3	60	6.1	360	...	....	....	...	..
			360		1,250	360	3.5	1,250	360	3.5
May 2..	6	2	300	3.3	990	...	....	....	...	..
May 2..	5	2	200	2.6	520	...	....	....	...	..
May 2..	16	3	50	5.9	295	...	....	....	...	..
			550		1,805	550	3.3	3,055	910	3 4

point of view, and without some record of the output from each stope the question of the proper deductions for stopes when the periodical estimates of ore reserves are made becomes largely a matter of guesswork.

The data recorded in book No. 1 lend themselves particularly well to graphical representation, and curves for each month are frequently plotted showing the total

STOPE OUTPUT—BOOK NO. 2

Stope No. 2 Date	Tons	Assay	Product	Product to Date	Tons to Date	Assay to Date
May 1.....	300	3.0	890	890	300	3.0
May 2.....	500	3.0	1,510	2,400	800	3.0

ore produced each day, the average assay for each day, the total tonnage and the average assay to date. At the end of each month an entry should be made in book No. 1 showing the true tonnage and grade of ore for the month as given by the smeltery returns.

At some mines from which shipments to the smelter are made only at comparatively long and irregular intervals, these figures may be gone into somewhat more elaborately in order to have an approximate idea of the net returns from each day's operations. If we take from the costs of the previous month, or from the last month during which work was carried on under similar conditions, an average cost per ton that will cover all items, we may write down a figure showing approximately the total cost of each day's work. From the daily tonnage and grade of the ore we may calculate the pounds of copper produced each day, and by assuming an average price for copper, we may obtain a rough idea of the profit or loss on each day's operations, or on the month's operations to date. Figures of this latter kind, when applied to the various grades of ore separately, are frequently of value in indicating just how low-grade work can be handled at a profit.

The extent to which the daily assays are subject to analysis will depend upon the requirements of each individual case and also upon the extent to which these assays can be relied upon.

The writers are quite aware that in the foregoing many important points have been touched upon very lightly or overlooked entirely, but their idea was not to discuss mine valuation or mining economies, but merely to give a general idea of the methods by which samples and their assays can be interpreted.

Gulf States Steel Co.

This company owns iron and coal mines, a blast furnace and steel works in Alabama. Its report for the year 1915 shows net earnings over all expenses of $608,943, from which were paid accrued dividends on the first preferred stock amounting to $191,100, leaving a surplus of $417,843, which is being applied to improvements and extensions of plant.

The production reported for the year is 368,394 tons coal, 138,211 tons coke, 82,382 tons pig iron, 135,967 tons steel ingots, 119,515 tons billets and slabs and 205,659 tons finished steel, chiefly wire, bars and nails.

Negotiations are proceeding looking to the construction of a byproduct coke-oven plant. For this purpose and for various other improvements, which the company's increasing business renders imperative, such as the equipment of the ore property, automatic stokers for the rod mill boilers, new machines and blacksmith shops, new warehouses for galvanized-wire products, the directors have offered to the stockholders certain unsold treasury securities the issue of which will bring the total up to $2,000,000 first-preferred, $4,000,000 second-preferred and $5,000,000 common stock.

History of the Miners' Phthisis Problem on the Rand

JOHANNESBURG CORRESPONDENCE

Shortly after the Boer war attention was attracted to the mortality among rock drillers on the Rand, "which is stated by medical men to be chiefly due to the clogging of the lungs by the dust inhaled in the prosecution of their mining work. It has been generally recognized that the application of water sprays at the working faces to allay dust, with or without the use of respirator, would very greatly minimize the dangers to health of this class of workmen." Everyone believed that rock drillers were the only men exposed to the disease, no one knowing anything about the danger caused by the fine dust from blasting and shoveling. In the year 1902, attempts were made to determine the extent to which rock drillers were affected. The sanitation and ventilation of the mines was deemed capable of great improvement.

The water Leyner drill was tried underground, but neither the machine nor the steel could do consistent work in the hard ground with unskilled labor. The Government Commission presented its report in 1903 and it first drew attention to the fact that all underground workers were subject to the disease and that most of the workers were affected. Numerous experiments to test water injectors, sprays and water blasts were carried on. A prize was awarded in 1904 for an atomizer and a patent water drill. Fans were introduced to aid the ventilation in a few mines, and the success of the experiment led to the adoption of numerous ventilation schemes in other mines. However, there was no true realization of the risks run and the issues at stake.

DRILLING IS NOT THE ONLY CAUSE OF DUST

Attempts were made about this time to introduce sprays attached to the machines, but the miners never bothered about using them. The trouble in drilling is that in most cases the miner shows his natives the upper holes to be drilled and then retires to his box some hundreds of feet back in the drift under the impression that the dust will not reach him there. Later investigations have proved the fallacy of this belief. Mine captains and shift bosses were more concerned in keeping the mine going than in trying to reduce dust conditions.

In 1906 the first dust-prevention regulations of the government came into force. It called for the regulation of blasting operations to avoid exposing miners to dust and smoke; the prohibition of anyone from entering the working place after blasting until the fumes had been sufficiently dissipated; it stipulated that machine drills should not be used unless a water jet or spray or other equally efficient means of allaying the dust was provided, and that the manager should maintain in good order all the necessary plant and material for allaying dust. The benefits to be derived from shorter working hours and confining the work of treating rock to one shift also received attention. The 8-hr. working day was made law in 1911.

In 1908 a regulation was introduced that water should be carried to every development face and to every dry

and dusty stope, and that the floor and sides of the working place should be kept wet and that dusty rock must be properly dampened.

In December, 1911, another revised edition of the mining regulations came into force. Powers were conferred on managers to take disciplinary measures to enforce the regulations. It was definitely stated that the supply of water and dust-allaying appliances became the duty of the manager and the responsibility for their proper use became the duty of the miners.

In 1912 managers began to exercise their power to fine men without the delay of calling in inspectors and holding a regular court. Men have, however, the right to appeal against any penalty. Unfortunately natives are exempt, and thus most of the underground workers are not under good control in this respect. In 1913 the regulations were again revised and the blasting of holes in development faces was prohibited unless an efficient water system was installed. On the air pipe between the water spray and the main air column, a check valve should be fitted to guard against water leaking back and getting into pumps or rock drills. At blasting time water is turned into the air pipe and the air turned on the working face, and a very fine diffusion of water in the escaping compressed air takes is thus secured.

Workers Compelled to Wet Working Places

No one is allowed to be at any place in a mine if the air contains dust, smoke or fumes perceptible to any of the senses. Rock drillers were compelled to keep the walls and roof of their working place wet for a distance of 25 ft. from the face. Natives drilling dry were ordered to use wet swabs around their drills. Blasting was forbidden except at the end of a shift without express permission of a mine official. Water and ventilation plans must be furnished to the government. The manager should supply ample clean water and cut off old and disused workings, which act as reservoirs for dirt and dust-laden air.

While these practical measures have been taken experimental research has been going on to determine the exact nature of the disease, the kind or kinds of dust that produced it, the value of respirators and the cause of the excessive mortality caused by the disease.

It has not yet proved possible to specify exactly, either from physical examination or chemical analysis, what kinds of dust are harmless and what kinds are harmful when breathed, but in general it seems that hard material is harmful, while soft is harmless. Large quantities of fine auriferous looking dust can be seen with the microscope in the lungs of men who have been exposed to dust and who have died of lung disease; but whether the dust has been harmless or not, it remains in the lungs for many years. Harmless hematite dust, easily recognized by its red color, was abundantly present in the lungs of a miner who died of fibrotic miners' phthisis, due to work on the Witwatersrand, although it was 13 years since he had worked in an iron mine and eight years since he had left gold mining.

By continual inhalation of crystalline siliceous dust of certain kinds, the lungs become predisposed to bronchitis and also to attack by tubercle bacilli, the effects of which constitute phthisis. It is very generally believed that a fibrotic condition of the lungs may be produced by the influence of dust apart altogether from infection by the tubercle bacillus. Annual experiments have proved that intense exposure to dust will produce fibrosis apart from tubercular infection, but though fibrosis (the practical conversion of the lung tissue into fibrous tissue) is commonly far more prominent in cases of miners' phthisis than in ordinary phthisis, the history of the cases I have seen seemed to point to tubercular infection as a main cause of final fibrosis.

Dr. Watkins Pitchford states: "Pulmonary silicosis implies an excess of silica in the lungs' tissue and the direct effect of this is to produce an overgrowth of the connective tissue of the organ and to thus impair its function. The condition so established is rarely fatal of itself until the affected lungs are invaded by the tubercle bacilli, when miners' phthisis is developed.

This infection seldom spreads to other organs, and infection is rarely communicated to others unless their lungs have been damaged. In any ordinary adult individual dust is present in the lungs to the extent of 10 to 15% of the ash, but in the lungs of those having died of phthisis 30 to 50% is silica. The most noticeable effect of silicosis is loss of expansion of the lungs. To suppress the disease, workers must be prevented from inhaling dust, and all those infected with tuberculosis must be excluded from the mines.

The condition on the Rand today is that a great improvement has taken place, but that portions of the mines are still badly ventilated and the air generally contains several milligrams of fine dust. The regulations are not well observed by the bulk of the workers, and there is no doubt that silicosis is still being contracted. It is to be hoped that ventilation will be further improved and that means will be found to enforce more rigidly the regulations. The next great step in advance will be the exclusion from work in or about the mines of anyone, white or black, infected with the tubercle bacilli. It is to be hoped that these few notes will be of service to those engaged in the campaign for better working conditions in the American mining industry.

Butte & Superior Copper Co.

The report of the Butte & Superior Copper Co. for the first quarter of 1916 shows that 164,500 dry tons of ore was milled averaging 15.692% zinc and 6.844 oz. silver per ton. The total amount of zinc in concentrates was 47,938,530 lb., a total of 92.855% recovery. Mining costs were $4.0341 and milling costs $1.5736 per ton—a total of $5.6104.

The value of concentrates sold and miscellaneous income was $4,623,143. Operating costs, taxes, etc., amounted to $1,068,203, leaving net profit of $3,554,940. Earnings are based on a price of 16.1052c. per lb. for spelter. The name of the company has been changed to "Butte & Superior Mining Co."

A Gallium-Indium Alloy

A few months ago F. G. McCutcheon, chemist of the Bartlesville Zinc Co., observed some mercury-like globules upon the surface of a leady residue from the distillation of zinc, say P. E. Browning and H. S. Uhler, in *American Journal of Science,* April, 1916. The appearance of these globules seemed to be due to the fact that the residue had been stored away in a warm place, and the phenomenon suggested to the observer the subjection of the

residue to a sweating process. This treatment resulted in a more abundant separation of the peculiar material, which, from the character of its source and its low melting point, suggested the element gallium. It proved to be essentially an alloy of that element with indium.

Through the kindness of the manager, K. Stock, and the chemist of the company, we were supplied with several grams of the alloy and a considerable amount of the leady residue. Rough analyses of these products show the gallium-indium alloy to contain about 10% of indium, with small amounts of zinc and lead, and spectrographic traces of copper and silver. The leady residue contains about 95.6% of lead, a fraction of 1% of copper, about 3% of gallium and indium together, and about 1.2% of zinc.

The Engineer in the Tropics

In the course of a paper on tropical appointments for electrical engineers, George R. Archdeacon, in the *Electrical Review* (London), Mar. 17, 1916, makes some observations of interest to the miner.

The question of total abstinence, or moderate indulgence in alcoholic drinks in the tropics is perhaps one of the most vexed questions of the day. Each side has its strong adherents. The author from personal observation and experience in various tropical districts, advises total abstinence from all alcoholic liquors between sunrise and sunset; after sunset he thinks a moderate indulgencce usually does not harm, but seems to act as a necessary stimulant.

The care of one's health in any tropical country must at all times occupy a serious portion of one's thoughts. Constipation at any time has evil effects, but in a tropical country its result is simply deadly. Try and imagine the effect of the climate upon the average young man who has all his life been used to cold fresh breezes, when he is suddenly dumped down, say, in the malarious and malodorous district of the River Amazon, where the temperature in his bedroom throughout the night is about 90° F., while the hydrometer shows about 85 to 95% humidity. One can well understand that living under those conditions, one loses all desire for movement or exercise and only cares to lounge about in pajamas, with a long iced drink at hand. Exercise must be the watchword and plenty of it, yet that is just the thing that one does not feel inclined to indulge in. This, again, is the occasion when a strong will must be exercised.

Another vexed question is quinine. Should one fortify oneself against malaria by taking, say five grains per day, or not? If one does this, trouble arises in the administering of it if one (in spite of being charged with the drug) contracts malaria. Here, again, we find the experts taking sides on this grave issue. Beyond doubt a daily consumption of quinine appears to reduce the risks of malaria; therefore, on the principle that prevention is better than cure, the author is of the opinion (in spite of slight deafness frequently caused by the habit) that one should never neglect the daily dose of quinine when in a malarious district.

First-aid remedies to carry depend largely upon what district is being considered—tropical diseases vary greatly in different districts. For example, yellow fever in Brazil, but never in India, Malay Straits or China; sleeping sickness and blackwater fever in West Africa but never in Brazil, China or India.

Malarial fever, however, is found in all tropical countries. Perhaps the most useful items to be observed are: Vaccination against smallpox; inoculation against enteric fever; chlorodine for cholera and dysentery; quinine for malarial fever; corrosive sublimate for wounds and scratches; ice-cap in case of sunstroke. [Tincture of iodine is far superior to corrosive sublimate for wounds and scratches.—Editor.]

Apart from the mosquitoes, chills are the most fruitful causes of illness, and they frequently lead to serious results. It is most important to avoid chills; many a man has gone to his grave through kicking off his sheet during the night and sleeping with the fan blowing a draft of cool air onto his body. A cholera belt should *always* be worn during the night.

The all-important question of clothes will doubtless require a considerable amount of thought. Again, local conditions must be inevitably the guide. Many districts have a fierce tropical summer, yet during the winter it is necessary to wrap up in thick furs and have a roaring fire in the bedroom. The style of one's clothes must be carefully considered. In India, Africa and the Malay Straits white patrol jackets buttoned up to the chin are usually worn, whereas in Brazil, Hongkong and Shanghai white jackets cut in a similar style to our lounge jackets at home, showing white soft shirt, collar and tie, are considered the only possible wear for a gentleman.

To sum up the whole subject, life, to be fairly certain and healthy in the tropics, should be (with a few reservations) maintained in a manner similar to that followed at home. The most important items to be observed are plenty of exercise, plenty of sleep, plenty of good food and plenty of optimism.

Alloys Used in Zeppelin Construction

The alloys entering into the construction of a Zeppelin brought down in France are given, with their analyses, by the *Revue des Produits Chèmiques* as follows, according to *Iron Age:*

	Angle Brackets, %	Channel Sections, %	Braces, %
Aluminum	90.27	88.68	99.07
Zinc	7.80	9.10	0.13
Iron	0.45	0.43	0.38
Silicon	0.37	0.49	0.36
Copper	0.73	0.70	0.06
Tin	0.11	0.15	...
Manganese	0.27	0.45	...
Nickel	Trace	Trace	Trace

The braces are evidently commercial aluminum, while the other parts are alloys of aluminum, zinc, copper and manganese. The absence of magnesium is noticeable. The impression has been that this metal was extensively used, at least as an alloy.

The Lease of the Venezuelan Salt Mines by the River and Coast Navigation Co. having expired on Dec. 31, and no applications for another lease having been received in response to a call issued in November last, the Government of Venezuela took over the direct administration of the salt mines on Jan. 1, 1916, in accordance with a presidential decree in the "Diario Oficial." The Ministry of Finance will establish warehouses or agencies for the sale of salt in such localities in Venezuela as seem most likely to furnish customers. The salt remaining in or en route to the existing warehouses or agencies at the termination of the contract with the navigation company will be subject to a tax of 0.25 bolivar per kg. (2.23c. per lb), this tax to be paid on or before July 1, 1916.

Details of Practical Mining

Convenient Inspection Gage for Hand Drills

By C. C. Phelps*

There are as many different ways of running a jackhamer as there are of killing the cat of proverbial distinction. One man is partial to the use of his right hand as the guiding force, another uses his left. Another uses both his hands, bearing down with all his weight. It is not unusual to witness a drillman in a restful pose, with one leg slung over the handle.

Motion study does not play much part in the efficient operation of this type of drill. About the same footage can be drilled, irrespective of the way the machine is handled. This is of course largely due to the fact that the rapidity of the hammer blows rather than their force accomplishes the speedy penetration; and the automatic rotation obviates rifling.

There is, however, one bad feature about careless handling of hand drills which is not generally appreciated—its tendency to increase the repair expense. Careless handling of the machine will tend to keep the steel and drill out of line, and in time this will wear the rotation sleeve in the front head of the drill, as illustrated in Fig. 1. The piston is designed so that the center of its face will strike squarely on the head of the steel shank. It is apparent that excessive wear of the rotation sleeve will permit the end of the shank to come in contact with the edges of the striking face of the piston, eventually chipping off pieces of the latter. These fragments may wedge around the steel or lead to further fracture of the piston. It is therefore highly desirable to inspect the rotation sleeve periodically and replace it before it wears to such an extent as to endanger the proper working of the piston.

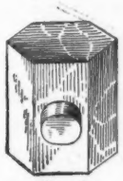


Fig. 2

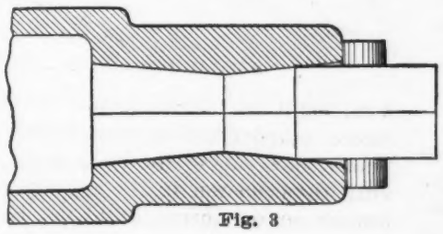


Fig. 3

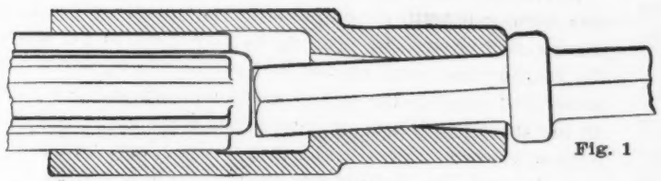


Fig. 1

DETAILS OF INSPECTION GAGE

For the purpose of determining when a worn sleeve should be replaced, a gage such as that shown in Fig. 2 is used by the test department of the Ingersoll-Rand Co., in connection with experimental machines. This gage, consisting of a piece of $\frac{15}{16}$-in. hexagon steel with a pin through it, of about the proportions shown, is used for testing sleeves for $\frac{7}{8}$-in. hexagon shanks. When the sleeve has worn sufficiently to permit the gage to enter and the pin to rest on the front head, as shown in Fig. 3, it is an indication that a new rotation sleeve should be substituted.

*Ingersoll-Rand Co., 111 Broadway, New York.

Oxyacetylene-Welded Casing for Deep Well

In the deep well of the Peoples Natural Gas Co., of Pittsburgh, at McDonald, Penn., there is considerably more than a mile of casing without joints in the ordinary sense, screw fittings having been abandoned in favor of oxyacetylene welding. The McDonald well is now drilled to 7,181 ft. It is claimed to be the deepest well in the United States and the second deepest in the world, its rival being in Galicia, about 7,350 ft. deep. The object in drilling the McDonald well was to determine whether there was another productive sandstone in this district at greater depth, the geologic evidence pointing to this possibility at a depth of about 8,000 ft., where it is expected that the Clinton-Medina formation will be encountered. The size of the well at the surface is 13 in., then 10, 8¼, 6⅝ and 4½ in. Heavy casing with screw fittings was used before it was decided to try the acetylene-welded casing. The actual weight of welded casing in the hole is 45 tons. The *Welding Engineer* for January, 1916, gives some interesting data regarding the welding, supplied by F. R. Goehler, Pittsburgh representative of the Oxweld Acetylene Co., which did the work. The welding was begun on Sept. 1 and completed on Sept. 29, though this time was not entirely consumed by the welders. The welds were done in 25 min. each without hurrying, and 15 to 20 min. more was allowed for cooling. Mr. Goehler writes:

In doing this work we had the ends chamfered to 60° to give us a chance to make a good, deep, wide weld and we built the welds up to ¼-in. reinforcement all around. All this casing was in 22-ft. lengths. The first 250 ft. was 5¼-in. O. D. casing with ⅜-in. walls, and the remainder, 6,071 ft., was 5-in. O. D. with ¼-in. walls.

Two lengths were welded together in the yard, then hoisted into the derrick and lowered. About 5 ft. of the casing was kept above the floor of the well and was supported by steel wedges placed between the casing and the steel block through which it was lowered. Then two more pieces, welded together, were hoisted, butted up against the last lowered casing and welded. The weld was permitted to cool sufficiently to permit the placing of the hand upon it before the wedges were removed and the casing lowered. At the top of the derrick was placed a plank with a half-circle cut in one side, against which the upper end of the pipe was held while the lower end was welded. This was done to insure absolute alignment of the pipe when welded, one of the vital things in this work being to have straight casing; otherwise the wire on the drill tools, working back and forth while drilling, would gradually cut the casing where it interfered.

At the bottom of the well there was a great deal of salt water, the pressure being estimated at about 3,000 lb. In the

first length of the casing lowered we placed a wedge, or "shoe," being an oak plug about 3 ft. long driven into the end of the casing and then soaked in water. This shoe was put in so that the salt water might buoy up the pipe, which was being lowered before the welds were cool, and thus take as much strain from the welds as possible. It was intended to drill this plug out after the casing was all lowered, but when about 2,500 ft. had been lowered, the plug blew out with terrific force shaking the ground around the well for a considerable distance. As a result of this we had to place, in the next piece of tubing that we welded, a plug with a small steel ring in back of it to hold it. After the entire 6,321 ft. of casing was in place, this ring and plug were drilled out.

Prior to the welded-casing experiment the operating company had used a string of heavy casing with screw fittings—the ends upset having a screw fitting, while back of the upset parts on each end were two collars fastened together with bolts. All this was necessary to hold the casing together, as the screw fittings themselves could not do this. Necessarily, these upset ends, bolts, etc., took up considerable room and did not permit of casing of the maximum diameter. One of the big advantages of welded casing was doing away with the screw fittings, collars and bolts, permitting the use of a larger casing, with resultant larger interior opening.

Drilling at this well, which is on the Robert Geary farm, 4 mi. from McDonald, has been suspended as two strings of tools and a bailer are at present in the hole and fishing has been in progress for some months. The drilling was commenced on Nov. 7, 1911, with Charles Swaub as chief driller, E. R. Alfred, assistant driller, and J. B. Walters and Frank Mackey, tool dressers. From 232 to 3,440 ft., the formations were similar to those found in other wells in the district; from 3,440 to 6,200 ft. slate predominated, after which black, white, gray and brown sand and salt were encountered.

A Tropical Ration List

Although ration lists have often been published, they have but rarely concerned themselves with the tropics. In going over some old papers recently, says R. C. Hardman,[1] in *Engineering and Contracting,* I found a list of rations used some ten years ago in the Philippine Islands by the Bureau of Engineering, or Bureau of Public Works, as it is now called. These rations were for the use of reconnaissance parties, survey parties and construction camps. It will be noticed that all the articles are such as can be well preserved under the extreme climatic conditions encountered in the tropics.

Provision	Quantity	Cost Unit	Cost Total
Pork sausage	6 cans	$0.225	$1.35
Beefsteak and onions	1 can	.325	.325
Corned beef hash	7 cans	.185	1.295
Compressed ham	2 cans	.26	.52
Beef stew	2 cans	.28	.56
Corned beef	2 cans	.275	.55
Mock turtle soup	2 cans	.27	.54
Bacon	4 lb.	.20	.80
Flour	17 lb.	.0405	.69
Corn meal	5 lb.	.095	.475
Rolled oats	5 lb.	.155	.775
Crackers, soda	4 lb.	.14	.56
Bread, Boston brown	4 cans	.13	.52
Pork and beans	2 cans	.18	.36
Corn	4 cans	.165	.66
Succotash	4 cans	.18	.72
Potatoes	15 lb.	.0235	.355
Onions	5 lb.	.0295	.15
Peaches, evaporated	2 lb.	.145	.29
Apples, evaporated	2 lb.	.17	.34
Prunes	2 lb.	.105	.21
Jam, blackberry	4 cans	.15	.60
Jam, strawberry	2 cans	.15	.30
Coffee	3½ lb.	.27	.945
Tea, Early Breakfast	¼ lb.	.40	.135
Sugar, granulated	10 lb.	.079	.79
Cream, Highland cond.	8 cans	.11	.88
Lard	5 lb.	.16	.80
Baking powder	1 lb.	1.07	1.07
Pickles	1 qt.	.425	.425
Vinegar	1 qt.	.065	.065
Mustard, French	¼ bot.	.205	.07
Salt	¼ bot.	.18	.06
Pepper	¼ box	.60	.20
Tomato catsup	2 pt.	.375	.75
Total			$18.60

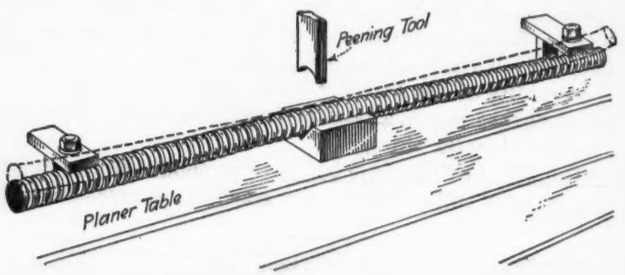
[1]Colorado Springs, Colo.

The rations were for one American for 30 days, and were ample for the time. In most localities it was possible to supplement this fare with chickens, eggs, fish, shrimp, crabs, frogs and various native vegetables and fruits. For Filipino "surveymen" the ration was three condensed-milk cans full of rice per day with an occasional can of salmon when fresh fish could not be obtained.

Straightening a Long Screw

The straightening of a special 3-in. screw that had been bent in transit was described by D. A. Hampson in the *American Machinist.* As the threaded part was 20 ft. long and the truth of the work must be undoubted, it was no usual job. The bend was ascertained to be a decided "kink" not far from the middle.

The first step, after definitely locating the bend, was to lay the screw in a V-block on a long planer, with the bend right in the block and the screw in the position shown exaggerated by the dotted lines. Clamps were put on each side of the block and the screw drawn down until the bend was in the opposite direction. Dents and bruises on the thread could not be tolerated, so leather liners were used in the block and under the clamps.



STRAIGHTENING A LONG SCREW

Springing the screw to line was not attempted. It was sprung beyond straight while the metal at the bend was swelled enough by peening to give a set to the screw. No peening was done on the face of the screw, but a concave-faced tool was made that could be used on the bottom of the threads. Three or four trials were made before a perfect job was secured, but it was done very easily and proved much less formidable than it first appeared.

Dragline Excavation Costs

Operators having conditions suited to the dragline method of mining will be interested in the following data from the *Excavating Engineer,* April, 1916. For excavating 50 mi. of open drainage ditch in the Pioneer Irrigation District, near Caldwell, Idaho, the Reclamation Servicce used Bucyrus dragline excavators.

The ditch depth varied from 7 to 14 ft. and in bottom width from 5 to 12 ft. with side slope of 1½:1. The ground surface consisted of heavy loam underlain by 7 to 12 ft. of either clay or hardpan. Probably 20% of the material handled was hardpan. The surface operated over was so soft that the caterpillar style of mounting was chosen, which gave a bearing surface of 120 sq.ft. with a bearing pressure of 920 lb. per sq.ft.

Each dragline excavator had a 50-ft. boom carrying a 1¼-yd. bucket; main machinery driven by a 50-hp. motor and swinging machinery by a 25-hp. motor.

Power was supplied from main line 44,000-volt transmission, transformed down to 440 volts for use by the dragline motors. Power cost 1c. per kw.-hr. and the average amount used per yard of material excavated was 0.9 kw.-hr.

Three 8-hr. shifts were worked, each shift consisting of an operator, an oiler and a laborer, the later during blasting. The amount excavated by each ship was staked, and an efficiency report for each operator compiled monthly and the highest ones published. Average digging results varied from 155 to 185 cu.yd. per hr., depending on conditions, the latter figure being the average maintained by one operator from Aug. 14 to 31 inclusive, 1915. During the best month's run, August, 1915, of total working time, digging consumed 77.2%, mechanical repairs 13.8%, electrical repairs 5.8%, moving 3%, and blasting 0.2%.

The unit-cost details for the entire contract, exclusive of depreciation and overhead cost, were as follows:

Labor:	Per Cu.Yd.
On excavations	$0.0105
On repairs	.0044
On blasting and drilling	.0012
On moving machine	.0029
On clearing right of way and trimming banks	.0006
On engineering and superintendence	.0033
Total labor cost	$0.0229
Supplies:	
Electrical power at 0.01 per kw.-hr	$0.0088
Repair parts and miscellaneous supplies	.0077
Wire rope and armored cable	.0015
Blasting supplies	.0015
Total unit material and supply cost	$0.0195
Electrical installation of transmission lines	$0.0125
Total unit cost	$0.0549

A Form for Calculation of Solar Observations

A form for the calculation and recording of solar observations, devised by V. K. Jones and given in the *Colorado School of Mines Magazine* for May, 1916, has been used successfully and, he says, is practically fool-proof. This form is printed on cards 3x5 in., suitable for filing. All data copied from the notebook are in the left-hand column, while the logarithms, etc., are in the right-hand. The results, which should be easily available for reference, are to be found at the bottom of the card.

Astronomically the card is in error because of the fact that the means of the observed azimuth and vertical angles are used directly in the calculation instead of working out each separate observation and averaging the result. A great number of observations were checked and the results have never been found to be more than two minutes in error. Ordinarily the two methods agree within one minute, which is well within the accuracy of the method of taking direct observations as a whole.

With these cards an observation can be easily worked up in from eight to twelve minutes, depending upon the accuracy required, and when the work is done the figures are in shape to be checked or consulted at any time. A cross-reference to the number of the sheet is entered with the notes in the fieldbook and the cards are filed in a card-index cabinet.

This method has not only proved a labor saver but has also proved to be an eliminator of errors.

DIRECT SOLAR SHEET

Formula: $\cos Az = \pm \frac{\sin dec.}{\cos A \cdot \cos L} - \tan L \cdot \tan A$

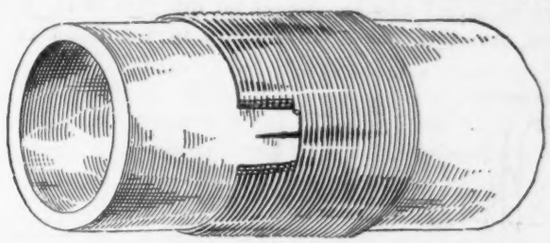
L = latitude | First term + for North and — for South dec's.
A = Corrected V. A. | For North Latitudes

Date		Dec.	
Hour		Diff.	
Station		Cor. D.	
Book No.			
Page			
Taken by		M'n V. A.	
Worked by		Refrac.	
Latitude		M'n alt.	
1. V. A.		Log sin D	
2. V. A.		Colog cos L	
3. V. A.		Colog cos A	
4. V. A.		Log. 1st term	
Sum		First term	
Mean			
1. Az.		Log. tan L	
2. Az.		Log tan A	
3. Az.		Log 2nd term	
4. Az.		Second term	
Sum		First term	
Mean		Sum = Nat. cos Az.	
Azimuth	360°00'00"	Bearing angle	
Needle		Add or sub. from	180°00'00"
Az. Cor.		True azimuth	
Needle Cor.		M'n. observed Az.	
Ass. var.		Correction	
True Var.			

Remarks:

Stopping Leaks in Pipes*

An effective way in which to stop leaks in pipes, particularly those caused by cracks, consists in wrapping wire in a double layer around the pipe over the leak. Furnace cement or Smooth-on is about the most suitable substance



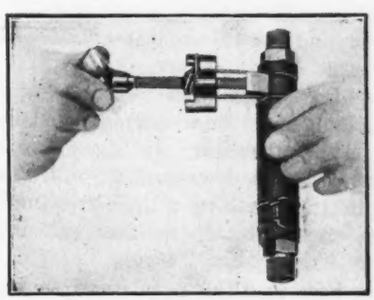
LEAK CLOSELY OVERLAID WITH WIRE

to put on the pipe to fill up the interstices and will serve to make the layers and pipe one solid mass.

The wire will strengthen the pipe at the same time and prevent its bursting. It should be applied as hot as possible, so that it will not expand after being wrapped on. If it is put on heated, it will bind tightly on the pipe when it contracts while cooling and will usually be found effective.

Chicago Hose-Clamp Tool

The hose-clamp tool illustrated herewith is manufactured by the Chicago Pneumatic Tool Co. and will be found useful where an exceptionally tight joint is required. A piece of wire is bent into U-shape over the block, and the two ends are inserted over the loop into holes in the crosshead and caught together by a turn. The distance between the crosshead and block is then increased by the operation of the spiral-threaded screw. When sufficiently tight, the crosshead is rotated, binding the ends together which are then cut off.



HOSE CLAMP TOOL

*By A. P. Connor, Washington, D. C., in "Power," Mar. 28, 1916.

Details of Milling and Smelting

Liquid Manometers for Light Pressures

An elementary analysis of the principle involved in the liquid manometer, or U-tube, for measuring low pressure of gases, such as chimney and furnace draft and the effect of unequal tube diameters is made by R. S. Bayard in *Power*, May 16, 1916, with particular reference to the question as to whether it makes any difference in the accuracy or the method of reading the instrument if the two glass tubes forming the U are of the same diameter, or "bore." In experimental work it often happens that two commercial glass tubes are not of the same internal diameter, especially if bought at different times. The effect of this difference is that the movement of liquid will be greater on one side than on the other, and this causes uncertainty in the mind of the observer, and it is surprising how often this question is raised.

If the two tubes are of the same diameter, the downward movement on one side must be exactly equaled by the upward movement on the other side. In Fig. 1 this is shown by a 1½-in. displacement downward at *A* and a 1½-in. increase of depth at *B*, making a total "reading" of 3 in. water, this being equal to the pressure measured.

The area of a ½-in. bore is 0.196 sq.in., and so the volume of the water supported by the gas is 3 × 0.196 = 0.588 cu.in. The weight of a cubic foot of water being taken at 62.3 lb., the weight of a cubic inch will be 0.03606 lb., and the weight of the column supported will be 0.588 × 0.03606 = 0.02120 lb. This weight being supported on an area of 0.196 sq.in., the pressure per square inch will be $P = 0.0212 \div 0.196 = 0.10818$ lb. per sq.in.

In this calculation the area of the tube enters into the problem twice—once as a multiplier to get the water volume and once as a divisor to get the pressure per unit of area, or per square inch. Thus the area of the tube cancels out in the calculation of the pressure and the net result is simply that the pressure per square inch is the product of the height of water column supported in inches, by weight of one cubic inch of water, or $P = 3 \times 0.03606 = 0.10818$ lb. per sq.in., the same as already found.

The area, or bore, of the tubes therefore has no effect upon the calculation of pressure when both tubes are of the same diameter, but what is the effect when the tube areas are unequal?

Referring to Fig. 2, tube *A* is ½-in. and the open tube *B* is but ⅜-in. bore. As before, let the total column of water supported by the gas pressure be 3 in. The relative downward and upward movements may be obtained by calculation, basing the problem, as before, on the fact that the volume forced out of *A* must be added to *B*. If then, tube *A* is ½-in. bore and its area 0.196 sq.in. and tube *B* is ⅜-in. bore and its area 0.11 sq.in., then, if x is the depression in tube *A*, the volume displaced downward is $0.196x$ cu.in. Also, as we have assumed the total column to be 3 in. long, as in the first problem, the sum of the depression in *A* and rise in *B* must be 3 in., so rise in *B* must be $3 - x$ and volume added to *B* must be $0.11 (3 - x)$ cu.in. But the volume lost by *A* must equal the volume gained by *B*, so $0.196x = 0.11 (3 - x)$, or $0.196x = 0.33 - 0.11x$; so $0.306x = 0.33$ and $x = 1.078$ in., which is the depression in *A*. The rise in *B* must be, as stated, $3 - x = 3 - 1.078 = 1.92$ in.

Thus the water-level movements are unequal, the depression in *A* being 1.078 in. and the rise in *B* 1.922 in., the latter being almost double the former.

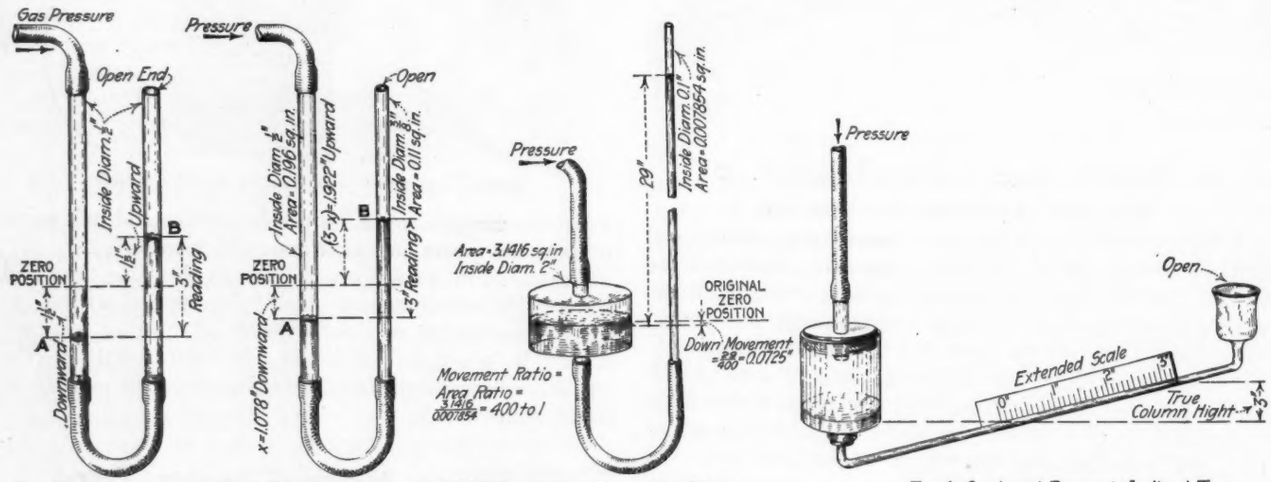


Fig. 1. Tube Diameters Equal

Fig. 2. Tube Diameters Unequal

Fig 3. Reservoir, or Barometer Type. Practically One Column Reading Only

Fig. 4. Combined Reservoir, Inclined Type

VARIOUS PROPORTIONS AND FORMS OF DRAFT GAGES COMPARED

Now the pressure represented by the gage may again be calculated by first figuring the weight of the column of water. The area of tube *B*, which is now holding the water column, is 0.11 sq.in. and the upstanding water column is, as before, 3 in.; so the volume is $0.11 \times 3 = 0.33$ cu.in. and the weight of this column is $0.33 \times 0.03606 = 0.0118998$ lb., and the weight per unit of area, or pressure per sq.in., is $0.0118998 \div 0.11 = 0.10818$ lb. per sq.in., as in the previous problem.

It makes no difference, therefore, in the result whether the two tubes are of large or small bore, nor does it affect the result if the bore of one tube is greater or less than that of the other. The only controlling factor is the height of the column, and the pressure measured is always the product of the height of the column by the weight of unit volume of the liquid used. If the height is in inches, the unit weight must be in pounds per cubic inch and the answer will be in pounds per square inch. If the height is in feet, the unit weight should be in pounds per cubic foot and the answer in this case will be in pounds per square foot.

The application of the foregoing leads to a practical simplification of the manometer gage. It was observed that the liquid movement in the larger side of the U was less than that in the smaller one, but that the total height of liquid supported will always be the same for the same pressure and liquid used. It is quite practical to increase the diameter of the pressure side of the U to such an extent that the most of the liquid travel will be in the smaller leg—in fact, so that the movement of the liquid level in the large leg will be negligible. This makes it convenient to arrange the "zero point" at the liquid level of the large-diameter leg and have the entire movement of the column, to all pratical purposes, confined to the smaller-diameter leg, and instead of measuring from two moving liquid levels, it is necessary only to measure from the fixed zero point to the height of column in the smaller leg. Of course there is a small error due to movement of level from zero in the large-diameter leg, but this may be made so little that it is negligible, so that the instrument needs to be observed only at one place—the height of the liquid column in the small tube. Many commercial forms of draft gages and some cheap barometers work on this principle. Fig. 3 shows such an instrument, the total reading being 29 in., while the corresponding depression of the "zero" side is only 0.0725 in.

In some cases the draft gage is made on a slant so that the scale may be much extended for close reading. Here the true column of liquid is of course the vertical height as before, but the scale may be laid out on the diagonal, or slant, so as to obtain much larger-scale divisions for a given vertical movement.

This is shown in Fig. 4, it being understood that the vertical dimension of 3 in. is the true liquid column height representing the pressure, just as in the previous case, but that the diagonal scale is laid off in large divisions so that the scale will read 3 in., even though the diagonal distance may be three times as great in reality. This makes it possible to read very small movements of the liquid column with accuracy. To be accurate, the slant of the tube must be exactly that for which it was calibrated and the instrument set level, as the movement will vary with the slant. Disregarding either introduces a grave error, and the instrument should be carefully leveled when set and occasionally checked up with a level.

Matte Sintering and Double Roasting

Among the metallurgical innovations developed by the staff at the Herculaneum plant of the St. Joseph Lead Co., according to the annual report, the following were particularly worthy of note:

Careful calculation of the thermal reaction taking place on the sintering machine and heat absorption data from a theoretical point led to experiments in roasting raw matte along with varying quantities of either calcite or dolomite (chat). From the foregoing, a successful, efficient and cheap procedure has been developed for desulphurizing matte. This consists in passing an equal bulk of crushed limerock or chat, thoroughly mixed, over the sintering machine. The resulting product is an excellent sinter quite low in sulphur. As the sintering process, when it can be made to work, is the cheapest known method of desulphurization, the invention and use of this process should be of great profit to this company and of great value to others engaged in similar lines of work. From a chemical point of view the interesting fact of this matter is that probably a ferrate of lime is made, the iron taking its acid valence. On the face of it the matter looks like the combining of two bases to make a fused salt. Therefore the foregoing explanation looks reasonable. Whatever the final chemical explanation may be, the practical results are first-class in every way.

After an extensive series of tests made with various mixtures, compositions and suction pressures in a small experimental apparatus, full-scale tests on the whole sintering plant at Herculaneum have been made in double roasters, the object being to get as high a lead tenor as possible in the final product, with the minimum of sulphur. This procedure had already been worked out successfully and commercially elsewhere, using a sintering machine for preroast and a H. & H. pot to finish with. The procedure is, therefore, not original. The results of the tests so far made have been successful, and it is estimated that the expense of the additional installation needed to carry the process out on the entire tonnage of this plant (195,678) would pay for itself in one year.

Don'ts for the Skinner

In the Anaconda Copper Mining Co.'s safety-first magazine, *The Anode*, for May, A. R. Walsh gives the following ten pertinent "Don'ts" for our old friend the mule skinner.

Don't get your animal excited.
Don't ride the door end of a car.
Don't use a short tail chain.
Don't ride an overloaded car.
Don't jump on a moving car.
Don't kick a switch; use your hands.
Don't take a chance with a car that is in bad order.
Don't take a chance with a defective joint; fix it.
Don't make a flying switch.
Don't kick a switch from the train.

The Commercial Electrolyte for Iron Production is given by Oliver W. Storey ("Trans." Am. Electrochem. Soc., Washington, D. C., meeting) as 150 grams $FeSO_4 . 7H_2O$, 75 grams $FeCl_2 . 4H_2O$ and 120 grams $(NH_4)_2SO_4$ per liter having a specific gravity of 1.125 at 20° C. Ammonium oxalate is used as an addition agent. The anodes are basic-openhearth steel, and the cathodes are ⅜ to ½ in. before being pulled.

Company Reports

Tamarack Mining Co.

The Tamarack Mining Co., Calumet, Mich., for 1915 reports a production of 3,888,150 lb. of refined copper produced at a cost of 17.07c. per lb. and sold for 19.10c. per lb. Including miscellaneous income the mining profit was $78,987. The company also received $230,000 from the sale of its mill and closed the year with a balance of $1,204,980 in quick assets. The following is the statement in part given in the report by the board:

Your directors have recently received from G. M. Hyams, one of the stockholders, a request that the company bring suit against the former directors and the officers of the Calumet & Hecla Mining Co. to recover damages for mismanagement of your property in former years.

Some months ago a suggestion was made that the Calumet & Hecla might consider a purchase of your company's property if an agreement could be reached as to its value. Your directors did not consider that they were sufficiently informed on the question of value, and they therefore employed an expert mining engineer, W. E. Parnall, who for many years operated the Tamarack mine and who is thoroughly familiar with its past history, to examine and report on the value of your company's property. After investigation at the mine itself and elsewhere, he has reported a valuation of the assets, other than mineral in the ground, at $4,616,734, from which should be deducted the company's debts of $349,286. He considers it impossible to put a value on the mineral veins, for reasons which will appear later.

Mr. MacNaughton, the present manager at the mine, has for some years been of the opinion that it does not pay to operate it, because the cost of getting copper out of it exceeds what that copper will sell for, except under the unusual conditions now prevailing. Mr. Parnall does not deny that the copper to be obtained from Tamarack by the methods now in use costs on the average more to produce than it will sell for, but he is of opinion that a different method of mining would be profitable. In this Mr. MacNaughton does not agree with him. Mr. Parnall points out that there is a large body of Osceola amygdaloid not ready for extraction, which, if developed, would make a much larger mine than the Tamarack has ever been, and he regards the ore now undergoing mining (both conglomerate and amygdaloid) as more properly to be worked and of more value in connection with the development and extraction of the unopened mineral. His conclusion is that if the production were largely increased, it would be profitable. He declines to set a value on the mineral, because the veins which he thinks ought to be worked in conjunction with those now blocked out are not opened up and cannot be seen and sampled. Mr. MacNaughton, on the other hand, regards the ore now opened up as valuable only to sell on the present high copper market and all development of the amygdaloid vein as money thrown away.

The officers of the Calumet & Hecla do not regard the unopened mineral bodies as of any value, and they do not think that increasing the production would prove profitable. The mineral now undergoing extraction is worth something because of the high price of copper, but they would not care to consider subsequent mining operations after the ore now opened up has been taken out. Therefore they place a much lower value on the machinery and equipment of the mine than Mr. Parnall does. This value is not susceptible of determination by experts unless it be first decided whether it is to be appraised on Mr. Parnall's theory or on Mr. MacNaughton's, and as there was no prospect of agreement between your directors and the officers of the Calumet & Hecla as to the theory to be adopted, no attempt has been made to agree upon a value. Owing to the radical difference of opinion as to the value of the orebodies and the mine equipment, further investigation seems necessary before this question can be determined. It is fair to say that the officers of the Calumet & Hecla did not consider it worth while to submit any offer for your property, because their views as to its value differed so widely from Mr. Parnall's, and the negotiations have proceeded at the request of your directors, who were of opinion that whatever the offer might be, the stockholders of the Tamarack were entitled to have it submitted to them for their consideration. Where Mr. Parnall and Mr. MacNaughton disagreed as to the value of particular assets, other than the mineral and the mine equipment, the opinion of independent experts was adopted, and a lump sum was added by the Calumet & Hecla for the mine and its equipment. The net result of the negotiations, which have extended over several months, is that the Calumet & Hecla offers to purchase all the assets of the Tamarack company, except its holdings of Mineral Range R.R. stock, for $3,563,486, and to assume and pay the existing debts of the Tamarack company. This means $59 a share to Tamarack stockholders. This offer is conditional upon the sale and delivery of the Tamarack property being completed by June 1, 1916.

It is agreed on all hands that the present method of mining cannot continue long and that it would be unprofitable except for the present high price of copper. The only practical alternative is to expand the production in order to reduce the cost. Mr. Parnall is of opinion that this can be done provided additional heads of stamps can be procured and the necessary money is forthcoming.

The Copper Range Co., Houghton, Mich., reports a net income of $3,564,762 from the operations of its mines and railroad during 1915, after deducting $1,854,524 for one-half the profits on the Champion mine, which goes to the St. Mary's Mineral Land Co. A dividend of $3 per share, amounting to $1,182,003, was paid. The following table gives costs and profits for the year:

COSTS AND PROFITS

1915	Production, Lb.	Cost per Lb.	Profits	Price Received
Baltic	12,028,947	9.50c.	$949,965.40	17.4c.
Trimountain	8,302,896	9.52c.	654,746.52	17.4c.
Champion, one-half	16,703,799	6.30c.	1,854,524.52	17.4c.
Copper Range Co.	37,035,642	8.06c.	$3,459,236.44	17.4c.

The Copper Range Co., which has succeeded the Copper Range Consolidated, now holds 99,990 shares of stock of the Baltic Mining Co., 99,353 shares of the Trimountain Mining Co., 96,500 shares of the Atlantic Mining Co., 50,000 shares of the Champion Copper Co. and 42,443 shares of the Copper Range Railroad Co. stock. The company has paid $15,168,749 in dividends to date. The average yield of fine copper per ton of rock stamped for the last 10 years is 22.50 lb. per ton. During the same period the cost has averaged 9.8c. per lb., and the average selling price was 15.1c. per lb. In 1915 the cost of producing copper was 8.06c. per lb. on a production of 37,035,642 lb. An average of 17.4c. per lb. was received in 1915 for copper.

The Mines Company of America, operating the El Rayo, the Dolores, Creston Colorada, La Dura and Grand Central Verde mines in Chihuahua and Sonora, Mexico, reports total receipts for 1915 amounting to $955,953, and expenses for mining and milling of $884,916, leaving an operating profit of $71,037. Interest receipts amount to $8,909, making a total income from operations $79,946. General expenses and taxes were $31,400, leaving a net profit for 1915 of $48,546. The company closed the year with current and working assets of $732,089, and current and working liabilities of $56,358, leaving a net balance of quick assets of $675,731. There is also a claim of $392,859 against the Mexican Government on account of the war losses. In the Dolores mine, 2,838 ft. of development work was performed on and above the 500-ft. level. At present the 600 and the 700 levels are in the water. The following table shows the ore reserves as estimated on hand Jan. 1, 1916:

	Tons	Assay Value per Ton	Total Value
Ore in place	114,298	$13.94	$1,593,015.00
Broken ore stored in stopes	12,365	14.21	175,678.00
Total	126,663	$14.00	$1,768,693.00

Values are based on $20 per oz. for gold and 50c. per oz. for silver.

The milling plant was not operated in 1915. A general summary of ore reserves for all the properties operated by the Mines Company shows a total of 418,016 tons of ore estimated to contain $4,414,393 in recoverable mineral.

The Utah Consolidated Mining Co., Bingham Cañon, Utah, reports for the year 1915 that 207,119 tons of copper ore and 65,129 tons of lead ore were mined which yielded 8,836,091 lb. copper, 17,777,604 lb. lead, 370,985 oz. silver and 19,387 oz. gold. Profits for the year were $1,128,122. During the year 1915 the company purchased the Bingham Copper Boy group of copper claims which has an area of 141.6 acres and adjoins the Utah Consolidated Mining Co.'s property on the north. It is stated that this ground has no developed ore, but has a fair prospective value. Ore reserves are estimated to contain 266,700 tons of copper ore, averaging 1.90% copper, 0.05 oz. gold, 0.69 oz. silver; and 43,500 tons of lead ore averaging 16.21% lead, 0.04 oz. gold, 4.96 oz. silver and 0.70% copper. The company received $24,750 in dividends from its holdings in the Anaconda Copper Mining Co.

The Centennial Copper Mining Co., Calumet, Mich., reports a production of 2,347,500 lb. of refined copper for 1915 and a mining profit of $142,439. There was also an income of $106,044 from the sale of 33,836 shares of the L. M. S. & R. Co. The following table gives results for the last four years:

	1912	1913	1914	1915
Tons of rock treated	106,517	85,443	138,136	150,191
Cost of mining, transportation, stamping and taxes per ton of rock	$1.9202	$2.179	$1.838	$1.753
Pounds of mineral obtained	2,567,385	2,324,040	3,311,780	3,029,880
Product of refined copper	1,742,338	1,612,262	2,287,130	2,347,500
Per cent. of refined copper in mineral	67.86	69.37	69.06	77.48
Pounds of refined copper per ton of rock treated	16.36	18.87	16.56	15.63
Cost per pound:				
Mining expense	11.74c.	11.55c.	11.10c.	11.21c.
Construction	0.00c.	0.00c.	0.00c.	0.00c.
Smelting, freight, commission, Eastern office and all other charges	1.32c.	1.37c.	1.11c.	1.16c.
Interest	0.40c.	0.46c.	0.35c.	0.08c.
Total cost per pound refined copper	13.46c.	13.38c.	12.56c.	12.45c.

Of the rock hoisted in 1912 1.04% was discarded as waste, in 1913, 5.98%, in 1914, 0.67%, in 1915, 0.92%. The company ended the year with $273,118 balance of quick assets.

The Champion Copper Co., Painesdale, Mich., reports for 1915 profit of $3,709,049 from a production of 33,407,599 lb. of refined copper, which was sold at an average of 17.4c. per lb. Dividends aggregating $3,100,000 were paid, and a balance of $1,815,868 in quick assets was on hand at the end of the year. To date the company has disbursed $11,500,000 in dividends. A three-year summary of operations is given herewith:

	Rock Stamped, Tons	Copper Produced, Lb.	Yield per Ton, Lb.	Cost per Lb.	Price Received	Net Profits
1913	421,849	12,080,594	28.64	10.71c.	14.89c.	$504,767.61
1914	614,854	15,807,206	25.71	9.21c.	13.38c.	658,175.99
1915	923,743	33,407,599	36.17	6.30c.	17.40c.	3,709,049.02

The average yield for 10 years is 25.68 lb. per ton; the average cost per lb., 8.78c.; and the average selling price, 15.17c. It is stated that openings made during the year show an average grade of ore. A large area of ground was opened between Nos. 2 and 3 shafts in what was previously supposed to form the foot wall. A total of 943,793 tons of rock was hoisted, of which 2.12% was discarded in sorting. During the year 220,920 cu.yd. of sand was used for filling.

The Mary Murphy Gold Mining Co., Cripple Creek, Colo., reports a total profit of $281,196 for 1915, out of which bond interest of $13,660 was paid, the balance credited to profit and loss account. The entire milling plant was operated throughout the year on the basis of 175 tons daily. The following table gives details of ore and mill products shipped for 1915:

	Tons	Value
Lead	1,925.31	$168,483.60
Iron-copper	1,741.32	43,470.31
Zinc	4,700.36	327,570.10
Company concentrates	8,366.99	$539,524.01
Company bullion (ounces)	49.73	613.83
Company crude ore	2,642.49	61,075.79
Tributers' crude ore	1,830.12	38,931.28

It is stated that flotation tests have been successful and that a large part of the profits for the year may be credited to the successful development of this method of treatment. Ore reserves are estimated at 12,100 tons broken in the mine of which 12,000 tons was milling ore. It is estimated that the mill ore will net $125,000 and the shipping ore $3,000. It is stated that other reserves are sufficient to operate the mill at its present capacity for six months and perhaps for a year. Development work consisted of 4,401 ft. of drifts, 1,170 ft. of crosscuts and 1,677 ft. of raises, at an average cost of $7.22 per ft. The mine produced 60,500 tons of ore at an operating expense of $5.56 made up of mining, $3.20; milling, $1.99; tramways, 12c., and general expense, 25c. There is set aside for the acquisition or development of new property $110,000.

The Wallaroo & Moonta Mining and Smelting Co., Adelaide, South Australia, in the 26th Annual Report for the year ended Dec. 31, 1915, shows profits for the year, after making provision for State and Federal income tax, of £12,165, and royalty on mining leases, £1,414, were £168,085. Dividends to the amount of £60,000 were paid during the year. The balance now standing to credit of profit and loss account is £163,321.

The Wallaroo mines produce 58,551 net tons of ore, which average 9.58% copper. The Moonta mines produce 7,994 net tons of ore, which average 16.82% copper.

The cementation plant at Moonta mines produced 938 net tons of precipitate, which averaged 73.07% copper.

The Wallaroo smelting works treated during the year the following ore and precipitates: Wallaroo mines ore, 57,839 tons; Moonta mines ore, 7,902 tons; sundry purchased ore, 641 tons; Moonta mines precipitate, 1,025 tons; total, 67,470.

From this was produced 7,653 tons of refined copper; 3.027 oz. of fine gold; and 2,884 oz. of silver, 996 fine. The production of sulphuric acid was 5,966 tons at a cost of 20s. 7¾d. per ton. The manufacture of bluestone has been discontinued.

The Silver King Consolidated Mining Co., Park City, Utah, for year ended Feb. 1, 1916, disbursed $255,032 in dividends and closed the year with cash and liquid assets amounting to $232,644, as compared with a balance of $210,471 on Feb. 1, 1915. The mine produced 13,719 tons of ore, the net receipts from which amounted to $519,478, yielding a net return of $37.87 per ton against $34.74 for 1914. The gain per ton was principally due to the increased prices for lead. The following table gives the output and dividends of the company since its incorporation:

Year	Dry Tons	Lb. Lead	Oz. Silver	Oz. Gold	Lb. Copper	Net Value
To Feb. 1, 1913	612	461,830	27,813	55.111	9,656	$27,143.36
Year ended Feb. 1, 1914	609	316,434	22,319	39.700	6,343	19,846.81
Year ended Feb. 1, 1915	9,987	5,593,786	503,784	513.763	257,912	346,990.40
Year ended Feb. 1, 1916	13,719	7,843,139	652,076	605.214	411,086	519,478.42
Totals	24,927	14,215,189	1,205,992	1,213,788	684,997	$814,856.52

Dividends to Feb. 1, 1913	.....
Year ended Feb. 1, 1914	*$308,791.17
Year ended Feb. 1, 1915	251,032.75
Year ended Feb. 1, 1916	255,032.60
Total	$814,856.52

*Derived from judgment paid by co-tenant.

Underground costs for 14,351 tons amounted to $2.59 per ton. Prospecting work cost $6.75 per ft. The development work consisted of 10,787 ft. of drifts.

The Allouez Copper Co., Calumet, Mich., during 1915 produced 10,043,459 lb. of copper at a profit of $924,680. Dividend payments amounted to $200,000, leaving a net balance of quick assets of $963,811. The following tables gives comparative results for the last four years:

	1912	1913	1914	1915
Tons of rock treated	333,618	236,663	354,457	534,705
Cost of mining, transportation, stamping and taxes per ton of rock	$1.613	$1.687	$1.583	$1.365
Pounds of mineral obtained	8,787,120	6,640,000	9,408,470	14,506,440
Pounds of refined copper produced	5,525,455	4,091,129	6,056,548	10,043,459
Per cent. of refined copper in mineral	62.88	61.61	64.37	69.23
Pounds refined copper per ton of rock treated	16.56	17.29	17.09	18.78
Cost per pound:				
Mining expense	9.74c.	9.76c.	9.26c.	7.27c.
Construction	1.60c.	0.16c.	0.00c.	0.19c.
Smelting, freight, commission, eastern office and all other charges	1.87c.	1.94c.	1.83c.	1.84c.
Interest paid	0.31c.	0.23c.	0.09c.	0.01c.
Total cost per pound refined copper	13.52c.	12.09c.	11.18c.	9.31c.

In 1915 of the rock hoisted 0.189% was discarded by sorting, as compared with 0.484% in 1914, 1.269% in 1913 and 1.868% in 1912. No. 1 shaft has now reached a total depth of 3,544 ft. and the bottom of No. 2 shaft is now 3,407 ft. from the surface. A total of 4,858 ft. of development work was done.

The Hollinger Gold Mines, Ltd., Timmins, Ont., report shows that since the beginning of 1912 and to the end of 1915 $4,170,000 has been paid in dividends, and $9,304,000 recovered from 728,000 tons of ore milled. The capital assets of the company have been increased during the year by expenditure for plant of $314,707 and for development work of permanent character of $3,923 and expenditures for deferred development of $95,336, including the cost of breaking 35,000 tons of ore in excess of that removed. Current assets show an increase of cash on hand from $370,468 to $429,487. Ore reserves have increased from 1,162,960 tons, valued at $13,358,420 on Dec. 31, 1914, to 1,600,800 valued at $16,031,600. Since 1911, 2,327,792 tons out of an estimated gross value of $25,810,383 have been blocked, and 726,992 tons having a gross value of $9,778,783 removed. The average value of all ore removed to date has been $13.45 per ton. The average value of the estimated ore reserve at the end of the year stood at $10.02 per ton, as compared with $11.49 at the beginning of 1915. The principal work of the year consisted in mining and milling 334,750 tons of ore having a gross value of $3,384,666 and an average value of $10.11 per ton. Exclusive of taxes and depreciation an actual working profit of $6.16 per ton was made. Gross profits amounted to $2,063,466 an increase of $276,787 over the previous year. Gold bullion was valued at $3,169,813 an increase of $480,459 in spite of the lower grade treated, the comparative values having been $13.67 per ton in 1914 as against $10.11 per ton in 1915. This difference was compensated for somewhat by a reduction of $1.23 per ton in the working costs. After making deductions for depreciation, etc., and the payment of dividends amounting to $1,560,000 there was $351,466 carried to surplus.

Oroville Dredging, Ltd., the California operating company of the Oroville Dredging Co., Ltd., operated two dredges during the year ended July 31, 1915, on the west side of the Feather River, according to the report just issued. The gross bullion return of the dredges was $228,594, from 55.97 acres of ground. The net profit by dredging was $114,303, and the profit from the company's other producing unit in California, the Boston Machine Shop Co., was $8,525, making a total net operating gain of $122,828. Besides this the company has investments amounting to over one million dollars, most of which is represented in 8% income notes of Pato Mines (Colombia), Ltd.

For dismantlement of California dredges $20,000 was written off during the year. A block of 4.35 acres, being the ground unworked by the old Exploration No. 1 dredge which sank Feb. 25, 1913, was dredged by the Natomas Co., of California, under an agreement whereby Oroville received one-half of the net proceeds, amounting to $1,514. The machinery on both No. 3 and No. 4 dredges is in good condition, and by using precaution the company expects to be able to prevent or retard decay of the hulls until all of the available ground is worked out.

The average depth dug by the Oroville dredges in 1915 was 28.4 ft., the average daily yardage 3,520 and the return per cu.yd. 8.89c. The total dredging cost was 4.45c., and the net operating profit 4.44c. per cu.yd. The expenses were subdivided as follows: Labor and material (operating), 1.46c. per cu.yd.; electric power, 0.82c.; water, 0.08c.; repairs, 1.60c.; smelting and express charges, 0.04c.; management, 0.27c.; taxes and insurance, 0.18c.; total, 4.45c. per cu.yd. Of the dredging expenses, labor and material amounted to 32.8%, and repairs amounted to 36%. The power expense was 18.3% of the total. The yardage, yield and net profit per acre last year were as follows: 45,911 cu.yd.; yield, $4,084; expenses, $2,042; net profit, $2,042 per acre. The two dredges operated 87.5% of the possible time during the operating season.

The Bingham Mines Co. of Salt Lake reports a net income of $197,923 for 1915, of which $102,458 was dividends received on the Eagle and Blue Bell Mining Co. stock. The Dalton and Lake group of mines was operated the entire year, while the Commercial for reasons was shut down Sept. 1. The following table is a statement of the ore shipped to the Salt Lake valley smelters:

Mine	Dry Tons	Gross Value	Freight Smelting Sampling and Assaying	Net Smelter Returns
D & L Lead	6,419.804	$105,227.58	$29,825.20	$75,402.38
D & L Copper	25,798.858	149,929.01	42,836.77	107,092.24
	32,218.662	$255,156.59	$72,661.97	$182,494.62
Coml. Copper	12,756.525	41,460.86	11,512.79	29,948.07
Total	44,975.187	$296,617.45	$84,174.76	$212,442.69

Total metal contents were; 3,399 oz. gold, 188,216 oz. silver, 2,244,078 lb. lead, 1,221,219 lb. copper.

The Eagle and Blue Bell Mining Co., produced 26,744 tons of ore having a gross value of $492,488 which was shipped to the smelters. The net smelter returns were $280,135 after deducting $212,353 for freights, smelting, sampling and assaying. The metal contents of this ore consisted of 1,288 oz. gold, 441,263 oz. silver, 8,275,734 lb. of lead and 3,806 lb. of copper. The net gain from mining operations, as shown by the report, was $150,392.

The Daly-Judge Mining Co., Park City, Utah, reports a profit of $538,755 for 1915 and dividend payments of $300,000. The mill treated 63,935 tons of ore which produced 10,828 tons of lead concentrates and 7,169 tons of zinc concentrates. The ratio of concentration was 5.8 to 1 of lead concentrates and 3.5 to 1 of all products combined. The mill was operated 539 eight-hour days with an average capacity of 357 dry tons per 24 hours. The slime settling plant has been installed in connection with oil flotation plant. The following gives details of production for the Daly-Judge Mining Co.: Crude ore sold, 5,809 tons; ore concentrated, 63,935 tons; total ore extracted, 69,744 tons.

AVERAGE VALUE OF ORE AND CONCENTRATES, PER TON

	Tons	Oz. Silver	Oz. Gold	Per Cent. Lead	Per Cent. Copper	Per Cent. Zinc	Per Cent. Iron	Sold For
Crude	5,809	30.32	0.034	17.73	1.86	10.82	7.67	$23.93
Lead concentrates	10,828	31.72	0.03	38.57	1.18	9.93	15.01	38.26
Zinc concentrates	7,169	17.41	0.015	3.77		44.46	6.08	68.08

Output Since Incorporation.

	Oz. Silver	Oz. Gold	Lb. Lead	Lb. Zinc	Lb. Copper
To 1915	4,977,485	11,158.22	105,647,108	77,162,053	2,512,434
1915	644,935	642.00	10,954,273	9,775,097	472,441
Totals	5,622,420	11,800.22	116,601,381	86,937,150	2,984,875

Total receipts from ore sales to 1915 were $5,441,420 and dividends were $855,000; during 1915 the ore sales and dividends were $1,041,413 and $300,000 respectively.

The Nipissing Mines Co., Cobalt, Ont., Canada, for 1915 reports total production of 4,097,391 oz. of silver valued at $2,222,256. Net receipts were $1,441,427. Dividends for the year aggregated $1,200,000. Based upon the production of 4,097,391 oz. and 77,904 tons milled, the cost per ton of ore was $10.023 and per ounce of silver $0.1906. Details of these costs are given in the following table:

	Per Ton Ore	Per Oz. Silver
Hydraulicking	$0.530	$0.0101
Diamond drilling	.017	.0003
Development and exploration	1.531	.0291
Stoping	1.314	.0250
Assaying and engineering	.113	.0021
Administration and office	.353	.0067
Boarding house and camp maintenance	.109	.0021
Insurance and taxes	.328	.0062
General and legal	.209	.0040
High grade mill	.646	.0123
Low grade mill	3.877	.0737
Depreciation	.780	.0148
Marketing product	.498	.0095
Corporation, N. Y. office and traveling	.157	.0030
	$10.462	$0.1989
Less rents and interests	.439	.0083
Total cost of production	$10.023	$0.1906

The total cost of production was 35.1% of the gross value of production. The Nipissing mine has produced from the date of its organization 41,209,238 oz. of silver having a gross value, including cobalt, nickel and arsenic paid for, of $23,428,184. For this production the company has received $22,158,065 from the smelters, and has paid dividends aggregating $13,740,000, including that declared Dec. 13, 1915, but not payable until 1916.

In surface prospecting, 111 acres were hydraulicked at a cost of $372.08 per acre. There were 445,653 cu.yd. removed from an average depth of 2.49 ft. The cost per cubic yard was 9.27c., made up of: Labor, 4.83c., power, 3.98c. and supplies, 0.46c. The average pressure at the nozzle was 136 lb.

Ore reserves are estimated at 182,748 tons, to contain 8,921,718 oz. of silver. The average price received for silver was 50.06c. per oz. Costs were reduced from $11.60 to $10.02 per ton of ore and from 19.80c. to 19.06c. per oz. of silver.

The Report of the Mason Valley Mines Co., Yerrington, Nev., for the year ended Dec. 31, 1915, shows that, since discontinuing operations in October, 1914, it has not been considered for the best interest of the company to resume mining and smelting operations until such time as a sufficient and satisfactory supply of other ores could be arranged for so as to derive the greatest benefit from the Mason Valley ores.

While negotiations with this object in view are still in progress, nothing definite can be stated now as to the probable outcome. During 1915, engineers employed by the company have canvassed the districts tributary to the smeltery, and have kept in touch with all new mining developments therein. This work is still being carried on and, as a result, some properties have been optioned and are being prospected and investigated.

The company's properties are being kept in good condition and ready for resumption of operations. The organization for this purpose has been reduced to a minimum. The copper unsold at Dec. 31, 1914, was sold early in the year at prices which realized $15,705 in excess of the inventory value after deducting all commissions, delivery charges, freight, refining, and all other operating charges not determined and paid Dec. 31, 1914.

In 1915 the funds of the company were invested in bonds, which on sale netted a profit of $153,415. The funds have since been invested in bonds, which return a good rate of interest. The sinking-fund requirements for 1913 were complied with by the cancellation of 49 of the company's $500 bonds, which have been purchased for $12,337, resulting in a profit to the company of $12,162.

Charges to profit and loss account for the year includes $5,446 on account of reduction in prices on inventory of mining and smelting supplies, depreciation on plant of $74,193, and a reserve for possible loss in accounts receivable, or other claims, $10,000. Net profits for the year amounted to $974. Together with profits of $12,168 on account of redemption of the company's bonds makes a total addition to surplus account of $13,143.

The North Star Mines Co. of Grass Valley, Calif., for 1915 reports a gross production from the North Star mine amounting to $1,089,750. Operating expenses amounted to $525,984, and there was spent for development $103,895, leaving a profit of $459,906. The company spent $181,935 for property purchase and improvements, leaving a balance of $277,971. Dividends amounting to $250,000 were paid. The company operated the Champion mine at a loss of $111,175, in addition to which $17,448 was expended for property purchase and $15,250 for improvements, resulting in a total deficit of $143,873.

The production of the North Star mine was derived chiefly from the 3,400-, 4,000- and 4,400-ft. levels and was obtained from 117,906 tons of rock mined and delivered to the mills. Of this 8,046 tons was sorted out as waste, leaving 109,860 tons of ore crushed, which yielded an average of $9.92 per ton. The average cost for operating was $4.79 per ton and 95c. for development expenses, making a total of $5.74 and leaving a profit of $4.18 per ton.

Of the total production 80.37% was obtained by amalgamation and 19.63% was recovered by cyanidation. It is estimated that 97.4% of the total gold and silver contents of the ore was recovered. The following table gives the detailed cost per ton mined and per ton crushed:

	Per Ton Mined	Per Ton Crushed
Mining	$2.822	$3.023
Milling	.478	.512
Cyaniding	.358	.384
Maintenance	.033	.035
Bullion	.026	.028
Miscellaneous	.288	.308
New York Office	.150	.160
Taxes	.244	.262
Accident and benefit	.084	.090
	$4.483	$4.802
Less sundry receipts	.014	.015
Net operating expenses	$4.469	$4.787
Development Expenses:		
North Star mine (9,988 ft.)	.882	.946
Total operating and development	$5.351	$5.733
Yield	9.259	9.919

The Isle Royale Copper Co., Houghton, Mich., reports a production of 9,342,106 lb. of copper during 1915, sold at an average of 18.36c. per lb. Silver sales amounted to $38,973, making total receipts $1,754,224. Expenses for operation totalled $1,255,947, leaving a profit of $498,277 for the year. In addition to operating expenses there was spent $139,533 for replacing the mill which was destroyed by fire in 1914 and $144,036 for an interest in the Lake Milling, Smelting and Refining Co. After these expenditures the net increase in current assets during 1915 was $214,709. The following table gives comparative results for the last 4 years:

	1912	1913	1914	1915
Tons of rock treated	531,105	314,679	474,349	680,270
Cost of mining, transportation, stamping and taxes per ton of rock	$1.54	$2.12	$1.49	$1.45
Pounds of mineral obtained	11,461,410	5,889,000	9,451,115	13,727,832
Pounds of refined copper produced	8,186,957	4,158,548	6,601,235	9,342,106
Per cent. of refined copper in mineral	71.43	70.64	69.85	68.05
Pounds refined copper per ton of rock treated	15.4	13.2	13.9	13.7
Cost per pound:				
Mining expense	10.01c.	16.07c.	10.67c.	10.56c.
Construction	0.20c.	0.73c.	0.53c.	1.50c.
No. 7 Shaft	0.15c.	0.27c.	0.00c.	0.33c.
Shaft "A" and explorations	0.05c.	0.01c.	0.00c.	0.00c.
Unwatering Huron mine	0.08c.	0.10c.	0.05c.	0.04c.
Reopening No. 1 shaft	0.00c.	0.00c.	0.13c.	0.23c.
Smelting, freight, commissions, eastern office, etc.	1.31c.	1.53c.	1.46c.	2.06c.
Interest	0.09c.	0.10c.	0.21c.	0.22c.
Total cost per lb. refined copper	11.89c.	18.81c.	13.05c.	14.94c.

The above cost of 14.94c. per lb. for 1915 includes extraordinary expenses during the year equal to about 2c. per lb.

Of the total rock hoisted the following percentages were discarded as waste: 1912, 14.7%; 1913, 15.4%; 1914, 12.4%; 1915, 15.0%. The first unit in the new mill was placed in commission June 7, 1915. The second unit was started July 9, and the third Aug. 26. The mill has been in continuous operation since completed and is handling 2,000 tons daily.

The St. Joseph Lead Co., Bonne Terre, Mo., reports a combined net income of $2,853,863 for 1915. Dividends amounting to $854,980 were paid. The average price received for lead at East St. Louis for the year was $90 a ton as compared with $74 for the previous year. The output of pig lead at the smeltery was 84,356 tons as compared with 77,404 tons produced in 1914. The following table gives details of income of the St. Joseph and subsidiary companies for 1915:

	Consolidation Total	Consolidation Eliminations	St. Joseph Lead Co.	Doe Run Lead Co.	Mississippi River & Bonne Terre Ry.	Bonne Terre Farming & Cattle Co.	St. Francois County Railroad Co.
Net profit from operations	$4,293,428.62	.....	$2,160,934.20	$1,740,284.87	$333,154.98	$30,870.42	$18,184.15
Other income	108,931.68	$802,418.25	681,620.19	100,579.75	125,038.04	4,111.95	.....
Gross income	$4,392,360.30	$802,418.25	$2,842,554.39	$1,840,864.62	$458,193.02	$34,982.37	$18,184.15
Income charges	902,395.84	230,748.05	660,341.97	308,283.90	135,902.30	14,353.82	14,261.90
Net income for the year	$3,489,964.46	$571,670.20	$2,182,212.42	$1,532,580.72	$322,290.72	$20,628.55	$3,922.25
Profit and loss charges (less credits)	636,100.94	.....	618,905.74	228,473.89	245,406.63	481.52	219.06
Surplus for the period	$2,853,863.52	$571,670.20	$1,563,306.68	$1,761,054.61	$76,884.09	$20,147.03	$4,141.31

The Bonne Terre division mined 589,422 tons of ore, of which 135,042 tons were mined from an area of 2.51 acres of virgin ground. The balance was mined from areas previously worked, covering an area of 5.06 acres. The total area mined for the year was 7.57 acres, which produced an average of 77,862 tons per acre, giving an average yield in concentrate of 3,041 tons of metallic lead per acre.

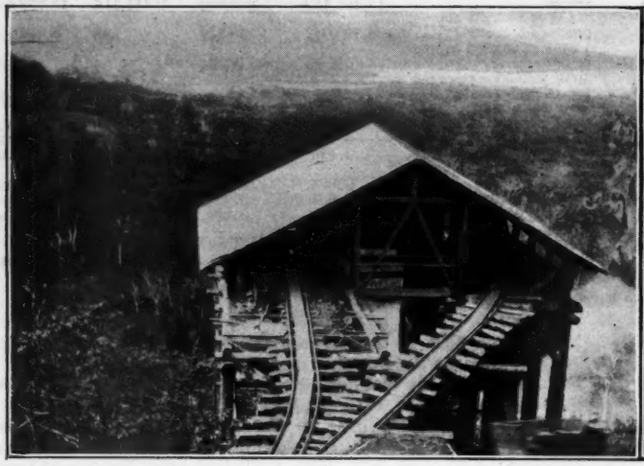
The Leadwood division mined a total of 489,285 tons of ore. Of this 485,002 tons was mined from virgin area of 10.72 acres. The remaining tonnage came from 0.15 acres which had been previously worked. The production per acre mined was 45,021 tons yielding in concentrate 2,292 tons of metallic lead per acre.

The Doe Run mines produced 1,045,916 tons of ore, of which 895,539 tons was mined from virgin area of 16.18 acres. The remaining tonnage was mined from ground previousy worked covering an area of 3.12 acres. The production equaled 54,192 tons of ore per acre, yielding in concentrate 2,179 tons of metallic lead per acre. The following table gives a summary of tons of ore milled, concentrates produced, tons of lead content and average yield of ore in metallic lead:

Division	Tons Ore Milled	Tons Concentrates	Tons Lead Content	Average Yield Lb. Lead per Ton Ore
Bonne Terre	592,687	37,033	23,146	78.7
Leadwood	490,283	36,973	24,971	101.8
Doe Run	1,044,363	62,373	42,003	80.4
	2,127,333	136,379	90,120	85.0

The power plants of the St. Joseph and Doe Run Lead companies on a basis of 34,359,458 kw.-hr. showed a power cost of 0.77c. per kw.-hr. The power consumption was equivalent to about 16.3 kw.-hr. per ton of ore mined and milled.

Photographs from the Field



ORE BINS AT HEAD OF COLORADO MINING CO.'S MILL

THE MINE TIMBER YARD OF THE COLORADO MINING CO.

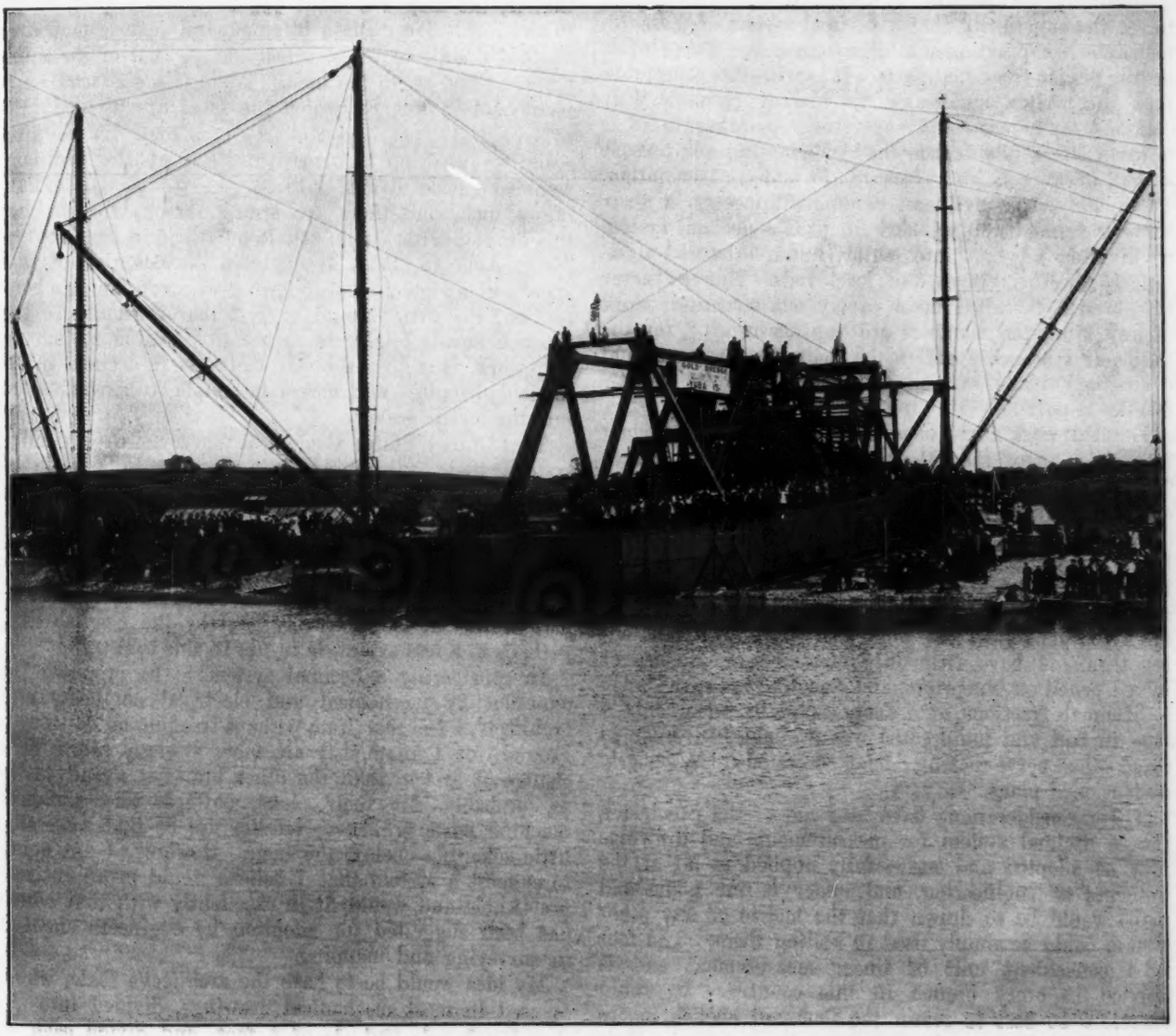
COLORADO MINING CO.'S OPERATIONS AT AROROY, MASBATE, PHILIPPINE ISLANDS

lo. 8 opencut, No. 1 level of the mine

The 175-ton, 20-stamp, all-slime cyanide mill

YUBA NO. 15, ALL-STEEL GOLD DREDGE, HAMMONTON, CALIF., READY FOR LAUNCHING

A large congregation of spectators at the ceremony. This photograph shows everything ready for the moment of launching



LAUNCHING YUBA NO. 15 GOLD DREDGE AT HAMMONTON, CALIF.

This is a 17-cu.ft., bucket-elevator, California-type dredge, built by the Yuba Construction Co., Marysville, Calif., and launched in the Yuba Basin field on Mar. 26, 1916. The launching was performed with considerable ceremony. This machine is the largest gold dredge in existence, as far as is known. Its bucket line is designed to dig a total of 80 ft. below the water level. The hull is 165 ft. long, 68 ft. wide, 11 ft. 6 in. deep and weighs 1,700,000 lb. It is a noteworthy addition to the already large fleet of California gold-recovering dredges

Correspondence and Discussion

Why the Metric System?

The editorial, "Beware the Metric-System Movement!" appearing in the *Journal* of Apr. 15, calls attention to a state of affairs that should awaken keen interest on the part of the engineering profession. Strong opposition should be aroused to the measure which it is proposed to "railroad" through Congress, making the adoption of the metric system compulsory, and deferred action secured until there should prove to be a more widespread demand for such a movement than now appears to be the case.

However, few persons in technical callings can fail to see the superiority that a decimal system of measurement and computation would have over the use of units having vulgar-fractional parts. It is with this conception that the writer undertakes to present through your columns some ideas and suggestions pointing to what he considers a practical method of adapting our present system of weights and measures to a decimal notation. Fortunately, the civil and mining engineers, in their surveying and mapping, have adopted a decimal system by dividing the foot into tenths, hundredths and thousandths on their tapes and level rods. But whenever this branch is called upon to lay out structural work of any kind, the members are "up against it," for the mechanical branches still make their measurements and draw their plans by using the inch with its vulgar-fractional parts.

In field work there is nothing that gives a stronger liability to error than the use of blueprints marked in feet and inches, and quarters, eighths and sixteenths of an inch. These plans are often drawn by mechanical draftsmen who have never had any field experience in laying out work, and the dimensions are frequently given in such a way that numerous calculations in the field are necessary, often under stress when a force of men are lying idle until the work shall have been laid out for them. I have frequently marked new dimensions in red pencil on blueprints, and sometimes changed them to decimal fractions of a foot, especially when only a tape in feet and hundredths was available, in order to avoid the nerve-racking delay occasioned by poorly dimensioned plans.

These considerations have lead me to the conclusion that a decimal system for measurements and drawings may be adopted and successfully applied to all of the branches of engineering, and under it our plans and maps would be so drawn that the metric or any other system could be simply used in scaling them. The foot is a convenient unit of linear measurement and is applied in every branch in this country. It would therefore be best to retain the foot and abolish inches and their vulgar-fractional parts, substituting in their stead, tenths, hundredths and thousandths of a foot. The chain, pole and link are becoming obsolete in land measurement, and feet and tenths are used instead. The mile has an even number of feet, as does $\frac{1}{10}$ mile, while $\frac{1}{100}$ and $\frac{1}{1000}$ mile work out to feet and even decimals. It is unfortunate that our unit of land area, the acre, which equals 43,560 sq.ft., is not a perfect square. However, by dividing it by 10 a perfect square is secured whose side is 66. It might be of advantage to adopt this as the unit of land measurement. It is just a trifle less than 0.25 hectare of the metric system.

The idea of adopting a standard system of scaling for maps occurred to me several years ago, when I was in the employ of a mining company as resident engineer. We used a scale in which the foot was divided into 300 parts, each part representing a foot on the mine maps—that is, the map was made $\frac{1}{300}$ natural scale, or 25 ft. to the inch. We made a large general surface map and adopted a scale of $\frac{1}{3000}$, which was $\frac{1}{10}$ that of the mine maps, or 250 ft. to the inch. There is a six-faced scale made and in use, on which the faces are divided into $\frac{1}{100}$, $\frac{1}{200}$, $\frac{1}{300}$, $\frac{1}{400}$, $\frac{1}{500}$ and $\frac{1}{600}$ of a foot. It was this scale we used on our maps instead of the ordinary engineer's scale divided into $\frac{1}{10}$, $\frac{1}{20}$, $\frac{1}{30}$, $\frac{1}{40}$, $\frac{1}{50}$ and $\frac{1}{60}$ of an inch, and there are strong reasons for making this the standard. In an article published in *Engineering News,* Aug. 18, 1910, I suggested the adoption of this system of scaling in the following words: "In this connection, the writer would suggest that it should be the practice among engineers to use this scaling system on map work, as it gives the map distances in decimal ratios to field distances and makes it simple to convert them into the metric scale."

The United States Geological Survey uses a similar system, their quadrangles being drawn to a scale of $\frac{1}{125000}$, and having on their margin a scale in miles and one in kilometers; $\frac{1}{125000}$ is $\frac{1}{250}$ of the $\frac{1}{500}$ scale suggested as the standard, and each small division on that scale would represent 250 ft. on the Geological maps. This system, then, would work out admirably for all map work. It is extensively used by the English and, perhaps to a less extent, is in use in this country.

In considering a decimal system to be proposed for adoption by mechanical and electrical engineers and architects, I feel that I am perhaps treading on dangerous ground, for I know they are more strongly averse to a change of system than the other branches. And justly so, probably, for their plans, patterns and standard machine parts are based on the use of that miserable little scientific enemy, the inch. However, I am going to suggest a system that I believe would prove entirely practicable and would fit in excellently with that which has been suggested for adoption by engineers engaged in surveying and mapping.

My idea would be to have the architect's scale, which is used in most mechanical drawings, divided into $\frac{1}{10}$, $\frac{1}{20}$, $\frac{1}{30}$, $\frac{1}{40}$, $\frac{1}{50}$ and $\frac{1}{60}$ of a foot, and divide each of the end divisions on each face into tenths and fractions, as the architect's scale now in use is divided into twelfths on the end divisions. The $\frac{1}{10}$ scale would be halfway between the 1-in. and the 1½-in. to the foot,

the $\frac{1}{20}$ would be a little larger than the ½-in., the $\frac{1}{80}$ a little larger than the ⅜-in, the $\frac{1}{40}$ larger than the ¼-in., the $\frac{1}{50}$ would be almost the same as the ¼-in., and the $\frac{1}{60}$ slightly larger than the $\frac{3}{10}$-in. For drawing to larger scales the $\frac{1}{10}$ could be doubled so as to make the plan ⅕ natural scale, and the $\frac{1}{20}$ could be adapted to a ½ natural scale. All present gages, patterns, etc., could be worked out quite closely to thousandths of a foot, and in any event, future work could be made to conform to these decimal dimensions. Mechanics' and carpenters' scales could be divided into tenth divisions, these tenths divided into tenths, and while the smaller divisions would be halved on the carpenters' rule, they could be divided into tenths, or thousandths of a foot, on the mechanics' measuring devices. The hundredth and half-hundredth of a foot, are very closely equal to the eighth and sixteenth of an inch respectively.

As has been stated in your columns, there would not be so much objection to changing the units of weight and of volume as there would to changing those of distance. This is because the former are more or less transitory in their value, while the latter are lasting and of record throughout our industrial and legal systems. However, it would be a simple matter to decimalize the pound, gallon and other units of weight and volume. The chemist and those of similar scientific pusuits use the metric system almost exclusively, and this is as it should be. As far as I am aware, there has been no decimal system devised for the measurement of time or for circular measurement. While there seems to be no particular advantage to be derived from the former, there would be in the case of the latter, as any of your readers who have figured out bearings from azimuths or deflection angles are aware. The degree might still be used as the unit of circular measurement.

The Centigrade measurement of temperature is extensively used and should be adopted as the standard. It is especially convenient to have zero the freezing point of water, and +100° the boiling point.

There seems to be no stronger reason that the nations should have a common system of weights and measures than that they should have a common language or a common monetary system. The latter would be more advantageous from a commercial standpoint than the first-mentioned, and it is a considerably simpler calculation to convert pounds into kilograms, or liters into gallons than it is to figure out the number of dollars and cents in a given number of pounds, shillings and pence. BENJAMIN H. CASE.

Asheville, N. C., Apr. 25, 1916.

Blast-Furnace Tapping by Electricity

While I am not aware where or when the opening-up of settler tapholes by means of an electric current was first tried, as a matter of historical interest I inclose a copy of a clipping from the *Greenwood Times*, B. C.:

Keeping matte tapholes open in large settlers, particularly where the matte produced carries enough copper to chill readily, is a difficult matter, the matte freezing ahead of the bar as it is driven in, where what Mr. Hixon calls "muscular metallurgy" is employed. Thawing by electricity is not new, but details as to methods of operation, current strength, etc., are not readily accessible. The scheme is as follows: Electrical energy to operate the works is received at 2,000 volts alternating current, but for electric haulage this is transformed by motor-generators to 250 volts direct current. The current in use for thawing should be of low pressure and large quantity, and therefore connection is made from the direct-current switchboard into a water rheostat, adjusting the volage to what may be required by the distance between the plates that receive the incoming and outgoing current. The adjustment is quickly secured by turning a longitudinal rod, upon which there is a right- and a left-hand screw, thereby drawing the plates closer together or moving them farther apart with corresponding variation of resistance. For convenience the tank is placed out of the way in the power-house basement and a mortise gear, operated by a handwheel from the level of the power-house floor, is employed. At the blast furnace the wire is attached to a carbon 1 in. in diameter by 30 in. long, and this being inserted into the frozen tap hole creates an arc that quickly melts everything ahead of it, the only trouble being to know when to stop and avoid a "runaway." An important point is that the operating workman should wear a mask and very dark goggles, otherwise there will be serious injury to the eyes and the skin of the face. In making connection the positive side only is connected to the carbon stick, the negative being grounded through the settler.

Unfortunately the date of the clipping was not noted at the time, but it was about 1904.

Tooele, Utah, Apr. 19, 1916. J. CUTHBERT WELCH.

Manganese vs. Chrome-Steel Roll Shells

Replying to M. R. Percy's letter in the *Journal* of Apr. 1, 1916, in the case of feed rolls crushing material, roughly, 1½ in. in size, my experience is that manganese-steel shells have at least double the life of those of chrome steel. In the case of finer material the difference is not so marked and consequently the advantage lies with the cheaper chrome-steel shell.

Apart altogether from the question of material used for roll shells, when coarse feed is delivered to the rolls steps must be taken to prevent corrugation or shells must be rejected before they are half worn out, and crushing costs must be high in consequence. Corrugation may be eliminated by the employment of rolls having automatic lateral adjustment, which are expensive (considered from the initial outlay point of view only), or by means of emery bricks kept pressed against the shell surface by a yoke. As a rule small plants cannot afford such luxuries as the former, and must rest content with the latter expedient. As to crusher plates, there can be no question that the advantage lies with manganese steel by a very wide margin. D. LAY.

12 Westbourne Rd., Forest Hill, London, S. E.,
Apr. 17, 1916.

New Process of Gold Recovery

Editor *Engineering and Mining Journal*,
New York City.

Dear Sir:

I will be personally obliged if you will publish the following communication which may prove interesting to many of your readers.

Thanking you sincerely, I am,

Yours very truly,

May 8th, 1916. W. WESLEY MILLER.

NEW PROCESS OF GOLD RECOVERY WANTED

Editor "Engineering and Mining Journal."

Sir: The writer knows the location of a vast gold-bearing zone, but fire assays do not give anything like the gold tenor proven to be in the material by certain wet assays. I want to get in touch with a millman having a new and economical process for refractory ores. W. WESLEY MILLER,
26 St. Pauls Rd., Ardmore, Penn.

Sulphuric Acid Production

The production of sulphuric acid, expressed in terms of 50° acid, in the United States in 1915 was 3,868,152 short tons, valued at $29,869,080, together with 189,795 short tons of oleum, or fuming acid, of different strengths, valued at $2,787,971, making a total of 4,057,947 short tons, valued at $32,657,051.

These figures, compiled by W. C. Phalen and just made public by the United States Geological Survey, include so-called byproduct acid, or acid produced at copper and zinc smelteries. The production from this source in 1915 was 1,056,830 short tons, expressed in terms of 50° acid, valued at $7,042,126, together with 59,189 short tons of oleum of different strengths, valued at $579,115.

The production of acid is tabulated as follows:

PRODUCTION OF SULPHURIC ACID IN THE UNITED STATES IN 1915, BY GRADES IN SHORT TONS

Grade	Quantity	Value	Price per Ton
50° Baumé	1,518,271*	$10,681,246	$7.04
60° Baumé	657,076	4,976,453	7.57
66° Baumé	1,019,024	14,211,381	13.95
Other strengths	189,795†	2,787,971	14.69
Total	3,384,166	$32,657,051	$9.65
50°, 60° and 66° reduced to 50°.....	3,868,152	$29,869,080	$7.72

PRODUCTION OF SULPHURIC ACID FROM COPPER AND ZINC SMELTERIES IN 1915, IN SHORT TONS

Source	Quantity	Value	Price per Ton
Copper smelteries, 60°	360,522	$2,749,633	$7.63
Zinc smelteries, 60°..	484,942	4,292,493	8.85
Other strengths	59,189	579,115	9.78
Total	904,653	$7,621,241	$8.42
60° acid reduced to 50° Baumé	1,056,830		

*Includes acid reported not only as 50°, but also as 52°, 53° and 55°. †Includes stronger acid reported as oleum, etc., carrying varying percentages of free SO_3.

Too much weight must not be attached to the values given in the tables, for sulphuric-acid prices have varied widely during the year. Producers who had previously entered into long-time contracts sold acid at prices much below those now current, especially during the last part of 1915. The trade in strong acids was active on account of the demand from the explosives and war-munitions industries, but this demand came only after the first quarter of the year and was very strong only during the latter half of the year. Before that time some acid plants were shut down. The average values given are therefore much below those which ruled on the market at the close of the year.

California Oil in April

Shipments of California crude oil in April, 1916, broke the previous records, except for the month of June, 1914. The amount was 8,785,715 bbl., or a daily average of 292,857 bbl. The total for June, 1914, was 8,986,951 bbl. There was only a slight increase in production in April as compared to March, so that the stocks were reduced by 1,413,235 bbl., which is the greatest reduction recorded in a single month in recent years. The Independent Agency reports indicates that the total production in April was 7,372,480 bbl., a daily average of 245,749 bbl., or an increase in daily average over March of 3,005 bbl.

Total stocks of crude in the field and pipe lines at May 1 amounted to 53,022,830 bbl. The reduction in total stocks for the first four months in 1916 has amounted to nearly 3,000,000 bbl. Development record for April shows 53 wells completed, as against 35 in March, and 220 wells being drilled, as against 195 at the close of March. At the end of April there were 77 rigs up, being an increase of 15 over March. Abandoned wells numbered 21, which was 16 more than were abandoned in March. There were 6,368 producing wells at the close of April and 6,282 at the close of March.

Mexican Complexities

There are several thousand people in this country who are intimately and thoroughly conversant with Mexico, Mexican conditions and the Mexican people. None of them lives in Washington, and no one there has a speaking acquaintance with any of them so far as can be judged from the way the Mexican situation has been and is being handled.

It is a unique experience to cross the bridge over the Rio Grande River from the strictly American City of El Paso and arrive in about three minutes in El Ciudad Juarez, which is not only typically Mexican, but is as foreign as though one had journeyed several days, instead of several minutes, into a distant clime. The streets are not paved, the houses are built of dobe brick, the gardens and lawns are not in front or around the house but are inside, surrounded by high *patio* walls, the churches are different, the people are different, different things are exposed for sale, and different kinds of food are sold and served.

Juarez, however, is not without traces of the Mexican's contact with the American. As one progresses into the interior of Mexico and reaches parts where the people are entirely unacquainted with Americans or outsiders, he finds the Mexican people primitive but kindly, shrewd but sincere. Down near San Bernardo, in the heart of Sonora, two American mining engineers, together with *mozo* and pack trains, having lost the trail, arrived late one night at a *hacienda* at which everyone had long since retired for the night. However, after the usual halloos, the *ranchero* roused his whole household, gave admission to the travelers, made up especial accommodations for them for passing the night and visited with them to the point of weariness, which only his courtesy made bearable. This is not an unusual experience in Mexico, but where in the United States would American ranchers give any such reception to wayfarers? These people were not of the wealthy and educated class. They were ranch people, living far removed from a city, wholly unaware of telephones or telegraphs and wholly unacquainted with the railroad.

An American traveler coming to a peon thatched hut anywhere at a similar unseemly hour will be furnished with a rawhide bed; a fire will be lighted in the open *brasero*, and the peon will roll a cigarette in corn husks and smoke stolidly while you dispose your impedimenta in his humble domain and make yourself comfortable for a night's lodging on the rawhide bed which is his most luxurious piece of furniture. This kindliness toward American travelers is probably more customary than not, but it is not found along the border separating this country and Mexico, and it is along this border where the greaser is found of the greasiest type. What makes the difference? The answer to this is that a Mexican peon or a Mexican laborer is a pretty good sort of a fel-

low until he gets in contact with the Americans and acquires the American's meanness and vices. Then he becomes a greaser, and he is always worse than the American from whom he acquired the degeneracy. It is not impossible to tell which section, in a general way, of Mexico an American is familiar with by his opinions of and experiences with the native people. If he is operating on or near the border, his opinion of the Mexicans is not fit for publication. If he is familiar with people who live down in the foothills of the Sierra Madre on the western slope—people to whom white men are more or less of a curiosity—he finds them kindly disposed, as here described.

The vast majority of them are densely ignorant, but that is their misfortune and not their fault. Down on the west coast one of these American travelers brought a 19-year old Mexican boy from the fastness of his cañon abode to the City of Alamos, a two-day saddle journey. The boy for the first time rode in a four-wheeled vehicle and came back to his master smiling, and with evident pride annuonced that he rode *en el carruaje* a long distance and was not afraid. This is primitiveness beyond the conception of the average American, and people like this, in the right hands, can be molded into most faithful servants and employees.

The Mexican people are different—peculiar in many ways; mentally, physically and psychologically. They are a mixture of the haughty Castilian, the proud Aztec and the humble Indian. The resultant is anomolous. When a Mexican rubs elbows a little with the white man, gets a little graft and a little power, he gets unusually topheavy and his sway over the unsophisticated simple people of the hills is complete. They are not to blame if the charlatan's version of our vacillation at Tampico, Vera Cruz and south of Columbus convinces them of our worthlessness and unreliability.

The normal Mexican is a peaceful fiesta-loving fellow who lives with the minimum of effort and the minimum of comfort. Now that the entire country has been bandit-ridden so long, be it by *cientifico,* constitutionalist, or what-not-ist, the Mexican people are hungry. The only place where they can get three meals a day is in the army. That is the most potent factor in keeping the ranks full, be the faction what it may. The leader steals the money or steals the grub and can feed his men, so "he should worry."

Now the Mexicans as fighters are not to be despised. Their forbears were proud and brave, and years of oppression have not wholly quenched this spark. Dr. Woods Hutchinson asseverates that any people fed a regular and ample diet and kept under military discipline for three years will become brave fighters. Chinese Gordon developed in this very way his famous and never-defeated troops from the peaceful Chinese, whose traditions for thousands of years have been most pacific and whom he was willing to pit against any equal number of troops in the world. By this token also the fighting forces of Mexico should not be despised even though as marksmen they may not measure up so well.

One of the racial traits of the Mexican is shrewdness. A beneficent Providence, who gives the blind an abnormally keen sense of touch, who fashions the feathers and skins of denizens of the forest to blend with their environment to their great protection, has made the Mexican *muy coyote* to compensate for some things denied him, and a white man who does not know the Mexican people and comprehend this atavistic trait is completely lost in dealing with them.

Any politician or near-statesman who attempts to deal with Mexicans on the assumption that they are just like we are, only a little more sunburned, will get into just such a mess as we now have down on the border.

Hollinger Consolidation Approved

TORONTO CORRESPONDENCE

The 1915 report of the Hollinger Gold Mines, Ltd., Timmins, Ont., Canada, is particularly interesting on account of the details of the Hollinger-Acme-Millerton merger. Since the report was written the annual meeting of the company has been held and the merger approved. It has been decided to form a new company called the Hollinger Consolidated Mines, Ltd., with capital of 5,000,000 shares, $5 par value. Of this amount, $24,000,000 will be issued for the various properties and plant and there will be $1,000,000 reserved for the treasury. The allocation of the capital will be as shown in the table.

ALLOCATION OF SHARES IN NEW HOLLINGER CONSOLIDATION

	Shares	Par Value
In the treasury	200,000	$1,000,000
Issued to Hollinger shareholders	2,400,000	12,000,000
Issued to Acme shareholders	2,100,000	10,500,000
Issued to Millerton shareholders	200,000	1,000,000
Issued to Canadian Mining and Finance Co.	100,000	500,000
	5,000,000	$25,000,000

An exhaustive and detailed report has been issued that shows the potential value of the different properties, particularly with reference to the persistence of values below the lowest depths to which the veins have been developed. In the different estimates made, it is shown that the Acme, while slightly lower in grade, has greater potentialities than the Hollinger.

The ore reserves of the Hollinger on Dec. 31, 1915, amounted to 1,600,800 tons averaging $10.02, or a total of $16,031,600. The ore reserves of the Acme on the same date were 1,776,360 tons averaging $9.06, or a total of $16,100,180. On the Millerton only a small amount of development has been accomplished and the ore reserves are estimated at 400,000 tons averaging $6.50, or a total of $2,600,000. It will thus be seen that the known ore reserves of the three principal properties aggregate $34,731,780. According to the arrangement Hollinger shareholders will receive four shares of the new stock for each share of the old stock that they hold. In addition to receiving the same rate of interest and increased flexibility of stock having a smaller market value, they will also have the advantages of freedom from loss in case of geologic disturbances found to affect the orebodies; a speculative chance spread over a larger area and lower working costs.

The Hollinger mill capacity is being increased to 1,900 tons a day, and this addition should be completed in May. Plans are under way to gradually increase the capacity to 3,500 tons a day. This work, together with the completion of the central shaft, will require a year's time and the expenditure of $750,000. During last year Hollinger treated 334,750 tons, and paid dividends amounting to $1,560,000.

Editorials

Conditions in the Silver Market

The price of silver has fluctuated considerably in the past week or two, falling off from the highest level reached, but rapidly recovering much of the decline, the changes being chiefly due to speculative movements in London. It still remains, however, at a very much higher point than it had reached in recent years, and there are no indications of any permanent or considerable decline. As we have already noted, a large part of this advance has been due to the insistent demands from the European mints for metal for coinage purposes, coupled with some improvements in the purchasing for India. The current demand for that country has been, however, largely satisfied from China, where it is evident that there must have been a considerable stock of hoarded silver accumulated, probably in the hope of improvements in business, which has been disappointed by the disturbed political condition of the country.

The causes for the great increase in coinage demand have been, as heretofore noted, the extensive withdrawal of gold from circulation, leaving silver to supply the call for metallic currency. The English and French mints during recent months have increased their output of silver coins eightfold to tenfold that of normal times and do not yet seem to have reached the limit of the demand. Silver currency in India has been drawn down to a point where more coinage appears to be necessary. In addition to the ordinary currency requirements of the country, a large quantity of silver rupees has been taken to pay the Indian troops in Egypt and to finance the campaign in Mesopotamia. Even the United States mint seems to be short of the metal, for it is understood that it is ready to buy a quantity of silver for subsidiary coinage, although the purchase has been delayed by the high prices.

This demand has come at a time when supplies are apparently not over-abundant. While the production of silver last year has not been finally ascertained, the best estimates put it at 195,600,000 oz., against 211,100,000 oz. in 1914, a decrease of 15,500,000 oz., which was chiefly due to the disturbed conditions in Mexico and to the reduced production of Australia on account of the difficulties arising over the contracts for the treatment of Broken Hill ores.

Going back of the abnormal conditions arising out of the war, we find that in the four years, from 1911 to 1914 inclusive, the production of the world was, in round figures, 884,000,000 oz. Of this, the exports to India absorbed somewhat over 300,000,000 oz., or more than one-third. The silver coinage by other nations, according to the United States mint reports, took about 380,000,000 oz., leaving of the four years' output somewhat less than 200,000,000 oz. for use in the industrial arts, for ornament, etc. Various causes, among which is not to be neglected the consumption of silver in photography and in the making of moving pictures, have increased the industrial demand, and it seems altogether probable that all the surplus was absorbed and that stocks of the white metal were not unduly large—certainly not large enough to meet the greatly increased coinage demand. The latest manifestation of this demand is understood to be the purchase by Russia of a large amount of the metal, of which no less than 15,000,000 oz. is to be minted in Japan. How long this demand will keep up is uncertain, but there is every prospect that its influence will be felt for some time. In view of the conditions in Mexico, it does not seem probable that production is increasing there, and there is no reason to expect any excess of supplies, although the high price will probably draw out all the surplus silver that is available. Our own production is probably on the increase this year, on account of the larger output of copper and lead, but this increase is not sufficient to offset the decline in other countries.

One result of the appreciation in the value of silver may be felt in the higher value of silver coins. In most countries during the past few years, these have been adjusted to the bullion value of the metal in a greater or less degree, and it is only where under the fiscal systems the silver coinage has been exchangeable for gold, that such adjustments have not been made. Thus, in Mexico where the silver dollar, or peso, has had its value fixed at 50c. gold, the present price of the dollar as bullion is from 5c. to 10c. above its face value and only the disturbed business conditions would prevent an extended export of the coins. A cable despatch today reports the sale of 7,500,000 silver pesos from the Philippines to India. If silver continues to go up, the same would be the case with the silver rupee of India, though a further advance—to about 44½ or 45d. in London—would be necessary before the export of rupees would be profitable on a large scale. The rise in silver may have an extended effect; at any rate it is one of the peculiar conditions arising from the present war which has altered and upset so many values.

Importation of Zinc Ore

One interesting phase of the new development of the zinc industry in the United States is strikingly illustrated by the reports of the Department of Commerce, with regard to the imports of zinc ore. Previous to the war our smelters imported a considerable tonnage of zinc ore from British Columbia and Mexico, but scarcely any, save for an occasional cargo, from anywhere else. According to the Department of Commerce the importation of zinc ore during the month of March last was 32,511 long tons, whereof 3,000 tons came from Italy, 2,100 from Spain, 1,422 from Canada, 16,024 from Mexico, 7,928 from Australia and 2,000 from French Africa.

With this fine development of an import trade, it is discouraging to hear that some short-sighted persons are making efforts to check it. In certain zinc-producing districts of the United States there is a revival of ideas about increasing the tariff on zinc ore, but of more immediate importance is the movement contemplated by

the Treasury Department to alter the established system of valuing imported ores, which at this juncture would be like throwing a handful of grit into delicate machinery.

Explosives and the Paper Famine

In connection with the growing shortage of paper stock, which has become a source of more or less alarm to all publishers and other users of paper in large quantities, there is considerable misconception as to the relation of the use of paper and paper stock in the manufacture of high explosives. As a matter of fact, the amount so used is extremely small. Guncotton is made from cellulose of high nitration, but raw cotton and not paper stock is used for this purpose. Smokeless powder is made from guncotton by further nitration and treatment with ether, alcohol and various alkalies for neutralization. To obtain satisfactory results when smokeless powder is used, it must be manufactured from cotton that has not lost its original cellular structure. Cellulose made from any other stock would give a powder that would be so erratic that it would be very unsatisfactory from a military standpoint, and military uses are almost the only ones to which guncotton is put, except what is used in the manufacture of gelatin dynamite.

The conservation of paper and paper stock is imperative, and if all users of paper, both large and small, would adopt the policy which some concerns have, a marked effect would be immediate. The Du Pont company publishes an interesting monthly regarding the products which it manufactures and their application in economic uses. It had a plan to double the size of this organ, which has a circulation of 200,000 per month, but this matter has been suspended entirely for the present and even circularizing not absolutely necessary has been eliminated. This is a broad-gage policy which this particular concern can more readily afford under the circumstances than some others, perhaps, but there is no doubt that more care should be exercised in general, and no paper or rag stock should be wasted or burned, but all should be very carefully conserved. Conservation of the other fellow's forest or water power a thousand miles away is common theme for dissertation, but conservation of one's own waste material and byproducts is a subject to which too little attention is given.

The American Engineer Abroad

Numerous communications showing why the American mining engineer should be excluded from the mining business in London and throughout the British Empire continue in the London *Financial News*. One of its correspondents says that the American control of the copper market is a good deal worse than the German-American control of the spelter market and asks if it be not outrageous that British Columbia copper ore and metal should be shipped to the United States for smelting and refining. "How weighty a matter this is," said he, "is partly shown by the millions Britain is now paying the American mining magnates for metallic copper extracted from British ore." Some may think that the control of the world's copper market ought to be taken away from the Americans, but so long as they refine and sell 75% of the world's total, of course that is going to be a difficult job.

The position of the American mining magnates in London itself is especially a focus of criticism. The expression of pique then becomes very pointed. "A shareholder" of the Zinc Corporation calls attention to the present unsatisfactory position of that company, which up to 1914 paid good dividends when zinc was £23 a ton and now pays nothing with zinc at £90. If about £300,000 of its reserve capital had not been used in ventures undertaken before the war, he generously points out, the money would now have been available as the nucleus of a fund for the erection of its own zinc works in England. Another shareholder hopes that there will be an effort to combine to get a new board free from American control, forgetting that an American brain created the Zinc Corporation and made it the brilliant success that it has been.

It would be a work of futility and thanklessness to undertake to clear up ideas in such muddled heads. The authors of these communications furnish the best evidence of the uselessness of their own services. What is to be said for a man who proposes seriouly that in the case of British mining institutions no person shall in future be eligible for membership unless he be a British subject, and further that all existing foreign members be requested either to become naturalized or, if they desire to remain members, to give an undertaking not to practice within British territory!

Notes from Official Reports

The official reports of the mining companies that have lately come out contain many bits of interesting and important technical information. Thus, in the Miami report it is remarked that for the purpose of checking up the assays of the low-grade sulphide ore developed by churn drilling in a certain area, 3,338 ft. of drifts were driven in the same area on the 420-ft. level. The average of 667 samples taken from the drifts was 1.24% copper, compared with 1.21% copper estimated from the churn-drill work.

It is also mentioned in the Miami report that the substitution of iron balls for pebbles as the grinding medium in the tube mills has made the attainment of increased tonnage more easily possible, with moreover a finer product than results from the use of pebbles.

In the Kennecott report we observed that an ammonia leaching plant is being built to treat the tailings from the concentrating mill. It is well known that the Calumet & Hecla has been investigating the subject of ammonia leaching and is now constructing a plant for that purpose, but it has not been heretofore published that the Kennecott company was experimenting on the same lines. It is rather a remarkable development, even in this age of extraordinary things, that so complicated a process as ammonia leaching may well be supposed to be should be contemplated at a mine far in the interior of Alaska.

Incidentally it may be remarked that Kennecott is probably the cheapest large producer of copper, its figure for about 57,500,000 lb. in 1915 being 4.54c. per lb., divided as follows: Mining and milling, 1.19c.; freight to smeltery, 2.18c.; smelting and refining, 1.37c.; selling, 0.18c.; general expense, 0.06c.; marine insurance,

0.09c. These extraordinarily low figures are due, of course, to the large size of the divisor—that is, the grade of the ore. The average copper content of the product shipped from the two mines of the company in Alaska during seven months of 1915 was 60.11% copper.

The Nevada Consolidated report is illuminating of the common idea that in estimating the porphyry mines the quantity of ore is usually underrated, while the grade is overrated and the cost of producing copper is usually figured too low. Nevada Consolidated was regarded several years ago as having delimited its orebodies and being a liquidating enterprise. In 1907, when production was begun, ore reserves were estimated at 14,432,962 tons averaging 1.97% copper. At the end of 1911 the ore reserves were supposed to be at the maximum, with 40,853,371 tons averaging 1.66% copper reported. However, we find them at 50,525,289, averaging 1.652% copper, on Dec. 31, 1915, notwithstanding that 18,473,011 tons had been mined and milled since 1907. The increase up to 1911 was due in part to the inclusion of ore of lower grade, but manifestly that was not so in the subsequent increase.

On the other hand, the present reckoning of about 1⅔% copper is materially lower than the original, which was upward of 2%. However, improvements in copper metallurgy have operated greatly in favor of the copper-producing companies and without any doubt have offset the original overestimates of grade of ore. With regard to cost of production the Nevada Consolidated report enables a real figure to be deduced. Up to the end of 1915 the company had sold 391,593,615 lb. of copper at an average of 14.128c. per lb., realizing $55,32,811. During this time it disbursed $19,975,893 to stockholders and, moreover, accumulated an earned surplus of $4,849,555. The cost of production was therefore $30,499,361, or 7.7808c. per lb. Of course this allows for the earnings of the Nevada Northern railway and the smelting of custom ore in the Steptoe Valley plant.

BY THE WAY

A demand for silver to which little reference has been made is found in the quantities used in the motion-picture business. Silver is indispensable in photographic chemicals, and a good authority estimates the quantity used by the "movies" at about 15,000,000 oz. yearly—which is quite an item.

⁂

A communication just received by a prominent firm of ore buyers in New York reads as follows:

"I sean yoir adv. im the Mining Joirnel where you buy Tungsten Ores what is yoir prices you ar paying for it please let me now as I hov abot 100 lbs. of of verry high persent Tengsten ores and consentrates I would like to dispose of. Yoirs trully"

⁂

I recently prepared specifications, says an engineer in *Power,* for two 10x200-ft. self-supporting steel chimneys. Upon opening the bids it was found that they were termed "steel stacks." In taking bids under a former specification for a masonry chimney, this did not occur. Upon looking the matter up it was found that a means or a structure for carrying off smoke could be termed a pipe, tube, funnel, shaft, conduit, flue, breeching, uptake, stack or chimney. It was also found that an accepted distinction among builders is, that if constructed of steel plates it is a "stack" and if of reinforced concrete or masonry it is a "chimney." This is not borne out to any great extent by writers dealing with the subject; they for the most part classify all under the name "chimney."

⁂

The American Smelting and Refining Co. has acquired ownership of three vessels, two of which will sail under the American flag between the United States and Chile and the third between this country and Europe. The boats are the "Republic," the "Sherman" and the "Potomac," with a combined gross tonnage of 19,800 tons. The price paid for each vessel was about $700,000, according to the New York *Tribune.* The "Republic" was salved in the harbor of Papeepe, Tahiti, one of the Society Islands, after having been sunk by its French owners to save it from being totally destroyed by a German commerce raider. Japanese interests formerly owned the "Sherman," which sailed under the Chilean flag under the name of "Gobernador Bories." The "Potomac" was owned by Sale & Co., of Liverpool.

⁂

The ancients were well acquainted with asphalt. Tacitus, in a description of the Mare Mortuum, written some time in the B. C.'s, gives the following account of the methods employed in collecting the material: "At a stated season of the year the lake throws up bitumen. Experience, the mother of all useful arts, has taught men the method of gathering it. It is a liquid substance, naturally of a black hue, and by sprinkling vinegar upon it it floats on the surface in a condensed mass, which those whose business it is lay hold of with the hand, and draw to the upper parts of the vessel; thence it continues to flow in and load the vessel till you cut it off. Nor could you cut it off with brass or iron. It shrinks from the touch of blood." Presumably, says *Engineering and Contracting,* when the vessel was loaded, the captain waved a bloody shirt and the surplus bitumen in terror leaped back into the lake.

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The *Mainischi,* of Tokio, states that in 1915 exports of copper from Japan amounted to 60,000 tons, of which 30,000 tons was consigned to Russia, whereas the amount of its production was also 60,000 tons, of which 40,000 tons represented domestic consumption. While the quantity of copper available for export was thus not more than 20,000 tons, total exports amounted to 60,000 tons. The explanation lies in the enormous imports of coins, principally from China and in a small measure from Chosen, which are melted down and refined, says the New York *Sun.* The Chinese li coin is chiefly imported from Tsingtau, where quotations stand at about $10 per 100 kin. From this coin are extracted not only copper, but also the more valuable tin and a considerable percentage of zinc, and the li coin has yielded handsome profits for its importers. Li coins have been hoarded up for centuries in China and are in great quantity.

Foreign Trade in Lead and Zinc

The imports of lead into the United States for March and the three months ended Mar. 31 are reported by the Department of Commerce as below in pounds:

	March	Three Months
Lead in ore	2,162,865	5,889,976
Lead in base bullion	4,339,071	13,649,915
Lead, metallic	258,889	275,924
Total lead	6,760,825	19,815,815

The actual tonnage of ore was 8,342 tons, of which 7,327 tons came from Mexico, 587 tons from Canada and 328 tons from other countries. The base bullion was nearly all from Mexico.

Imports of zinc in all forms in March and the three months ended Mar. 31, are reported by the Department of Commerce as below, in pounds:

	March	Three Months
Zinc in ores	28,326,482	96,473,196
Metallic zinc	163,067	435,096
Zinc dust	323,281	779,253

Of the zinc dust imported, 477,633 lb. came from Japan. The total tonnage of ore imported for the three months was 110,293 tons; 32,044 tons being from Mexico, 163 tons from Costa Rica and Guatemala, 90 tons from South America, 4,093 tons from Canada, 3,468 tons from France, 5,379 tons from Spain, 5,719 tons from Italy, 2,000 tons from Tunis, 218 tons from China and 57,321 tons from Australia.

Exports of zinc from the United States in March and the three months ended Mar. 31, were, in pounds:

Exports	March	Three Months
Zinc, pigs, bars, etc., from domestic ore	19,472,851	37,705,813
Zinc, pigs, bars, etc., from foreign ore	1,149,109	16,049,543
Zinc plates and sheets	5,869,655	17,189,115
Zinc blocks, etc., reëxported	336,000	336,000
Total metallic zinc	17,827,615	71,280,471
Zinc dross	2,530	3,209,445
Zinc dust, reëxported	36,700	96,419

Exports of metallic zinc in March were slightly less than those reported last year, the difference being 731,539 lb., which is 3.9% only.

Manganese Supply of Germany

From time to time there have appeared statements in the press to the effect that German metallurgists had discovered a process of making steel without the use of manganese alloys. Chief among these was a boast by Dr. E. Schroedter, a metallurgical writer, that German steel masters had been able to carry on their operations without importing manganese ores. An interesting statement with regard to this, written by "A Belgian Engineer," appeared in *Iron Age* of Apr. 27, the substance of which is given below:

The very healthy financial condition of the big German steel companies and the foresight of their purchasing departments, as well as the nature of the trade, favored an accumulation of great stocks of these ores in the yards of the blast-furnace plants. Thus the war found most of the works with a handy reserve, which with the reduced production of steel lasted about 10 months.

The invasion of Belgium and northern France with their important iron industries and the capture of Antwerp gave to the Germans the ore stocks of that region. All the manganese ores were confiscated by the military authorities and carefully shipped to the Westphalia district under the expert supervision of a technical commission. It is futile to attempt figures, because no shipping data of Antwerp are available. I only recall that Belgium and northern France have capacity for the production of 6,000,000 tons of pig iron a year, mostly steel-making pig. Anybody will be able to draw conclusions about the importance of the manganese item.

In the spring of 1915 the Siegen and Nassau mines, which before the war were not worth working on account of the low percentage of manganese (about 15 to 20), the high cost of mining and the competition of the imported ores, were pushed to the highest production possible to meet the demand of the market.

In the summer of 1915 prices went up, scarcity was felt and the winter campaign was in sight. Substitutes for manganese ore were looked for and found. The most important was the slag of the ferromanganese blast furnaces of Westphalia, worthless before the war and accumulated as a nuisance in immense cinder dump hills. As every metallurgical engineer knows, the blast-furnace process involves a large loss of manganese, the slag taking it up. This slag, with 8 to 14% manganese, gives under the present conditions in Germany a pretty fair ore, its mining cost being low and the slag especially fit for flux additions for basic pig iron. The only disadvantage of its use—the high coke consumption per ton of iron blown—is not serious, as fuel is available in the empire. The enormous supply of this substitute will certainly help to lengthen the war.

The secret of the German metallurgist, which I think a recent German writer had in mind when referring to the way in which Germany has dealt with the manganese problem is merely the spirit of saving that characterizes all the European metallurgists, especially the Germans. Savings and theoretical efficiency are the passwords of the iron industry there, and there is more freedom to the technical expert than the sharp business man of America allows his engineer. To illustrate by an example: Premelting of ferromanganese at basic-bessemer plants gives just enough saving of metal to pay for the melting furnaces and to balance the fuel cost. The practice is common in Germany, but is considered here as an unprofitable complication.

Even considering the reduced war production of steel in Germany (to about two-thirds normal), everybody must admit that scarcity of raw materials exists and that the prices of ore have gone up, but manganese is still available. But I question if even the hampered manufacture in Germany under government control drives the price of ferromanganese to the high mark now paid in America under the pressure of speculation. Germany will not face a serious situation in manganese before the spring of 1917.

Sicilian Sulphur Production Much Reduced

The Consorzio's figures for Silician sulphur production for the month of February, 1916, the latest official statistics, show a marked decline in the output. Sales, on the other hand, exceed those of the previous year, and stocks are correspondingly reduced.

In February, 1916, the production was only 16,865 metric tons, as against 24,799 tons in the corresponding month in 1915. Shipments for the month were 53,023 tons, as against 35,121 in 1915. There were marked increases in the exports this year to the following countries: France, Great Britain, "Greece and Turkey," "Spain and Portugal" and South Africa. Stocks on hand at the end of February were 258,766 tons, as against 365,330 tons last year. Sulphur stocks in Sicily are the lowest they have ever been since the Consorzio took over the direction of this industry.

Magma Copper Co.

The report of the Magma Copper Co. for the first quarter of 1916 shows a production of 2,043,784 lb. of copper. The average cost was 9.13c. per lb., and the average price received was 22.39c. per lb. The operating profit for the quarter was $270,201, and the average profit per month was $90,067.

A Map of the Area Around Columbus, N. M., is included in Bulletin 618 just issued by the United States Geological Survey. The map shows in detail all the natural and artificial features as far north as Deming.

PERSONALS

Albert Wright of Havana arrived in New York this week.

F. A. Dalburg, recently at Ralston, Penn., is now at Lima, Peru.

E. M. Murphy, recently at Rolla, Mo., is now at Vinita, Okla.

Harry J. Wolf, of Denver, is inspecting mines near Butte, Mont.

Franklin Osborn, recently in Chile, is now at Peabody, Mass.

H. P. Henderson is in Cuba and will return to New York about June 1.

C. M. Weld reached New York last week after a protracted stay in Cuba.

Dr. R. W. Raymond has gone to his summer home at Washington, Conn.

Bennett R. Bates, recently in Johannesburg, Kern County, Calif., is now in Chicago.

W. W. Adams, recently at Minas Palomas, Coahuila, Mexico, is now at San Antonio, Texas.

M. L. Uglow, recently at the University of Minnesota, Minneapolis, is now with the Cerro de Pasco Mining Co. in Peru.

W. F. Devlin has recently been appointed superintendent of the mill of the Silver King Coalition Mining Co. at Park City, Utah.

George J. Wilson, formerly of Philadelphia, has entered the firm of Wilson, Lackey & Co., of Los Angeles, Calif., as a general partner.

Edwin E. Chase and son have returned to Denver, Colo. from a trip to the San Diablo Mountains in the southwestern part of Texas.

C. E. Reese, mill superintendent of the Temiskaming mine, Cobalt, Ont., has been appointed also superintendent of the Beaver mill at Cobalt.

Walter M. Brodie has been seriously ill at the Buckingham Hotel, New York, for the past three weeks, but is progressing favorably.

Dave Irwin, foreman of the Burro Mountain Copper Co., at Tyrone, N. M., visited and inspected the mines and plants of the Detroit Copper Co. and the Arizona Copper Co., at Morenci, Ariz., recently.

Dr. Ralph H. McKee has resigned his position as professor of chemistry in the University of Maine, to become head of the research department of the Tennessee Copper Co. with laboratory headquarters at Ridgefield Park, N. J.

Dr. Willet G. Miller, provincial geologist of Ontario returned to Toronto on May 14 from a three months' trip to England and France, and sailed from San Francisco with T. F. Sutherland on May 23 for Australia and New Caledonia.

Milton H. McLean, general manager of the Detroit Copper Mining Co., Morenci, Ariz., is now making a business and pleasure trip to New York and other eastern points. Dr. A. V. Dye, of the Phelps-Dodge corporation, acts as general manager of the Detroit company in the absence of Mr. McLean.

E. J. Bruderlin, of the smelting plant at Salida, Colo., who was recently married, will accompany Mr. and Mrs. F. E. Weeks, consulting engineer of the Ohio & Colorado Smelting and Refining Co., on a trip of inspection to the mines and smelting works in Chile. He will be gone about four months.

Walter K. Mallette, for some time with the engineering force at Anaconda, has resigned to take charge of the construction of the Bunker Hill & Sullivan smeltery at Kellogg, Idaho. He is now in San Francisco consulting with Bradley Bruff & Lebarthe, the designers, but will leave for Kellogg in a few days.

William F. Jahn, mill superintendent of the New York & Honduras Rosario Mining Co. for the last three years, has returned to the United States. His address for the next few months will be Riebeling, Mont. F. C. Devereux is now in charge of the New York & Honduras Rosario mill at San Juancito, Honduras.

Charles A. Chase, mining engineer and manager of the Liberty Bell Mining Co. at Telluride, Colo., met with a serious accident May 13, when his automobile went over a bank on a steep mountain road in the Boulder County tungsten field. Although his head was badly cut and his left wrist broken, he is recovering speedily.

W. C. Douglass, formerly assistant safety engineer for the Butte mines, has resigned his position with the Bureau of Safety of the Anaconda Mining Co. to accept a position in the operating department of the Kennecott Copper Corporation. T. Oaas, formerly shift-boss at the Tramway Mine, has been appointed assistant safety engineer for the Butte mines.

OBITUARY

Dr. Elmer L. Corthell, an eminent civil engineer and president of the American Society of Civil Engineers, died May 16 after a long and successful career.

William S. Wintersteen died recently at Bethlehem, Penn., aged 58 years. He was a noted chemist and was, for many years, connected with the New Jersey Zinc Co., part of the time as head chemist.

Louis Philip Smith died recently in Butte, Mont., aged 84 years. He was born in Albion, N. Y., but went West when a boy. After some years spent in Colorado, he went to Montana and was one of the five men who discovered the famous placers of Alder Gulch. Recently he had been working the Little St. Lawrence mine near Centerville.

James Harvey Payne, a graduate of the Massachusetts Institute of Technology, died recently in Baltimore. He was connected at different times with several cement manufacturing companies and with the Braden Copper Co., of Chile, but recently had given most of his time to consulting work. He was a specialist in the use of rotary furnaces and had designed and constructed several plants.

Joseph Tatnall Lea died in Philadelphia, May 12, aged 77 years. He was one of the oldest and best known men in the Philadelphia iron trade, having been in business in that city for over 50 years. He represented many blast furnaces and other manufacturing corporations and was largely interested in several of them. For some years he was vice-president of the Algoma Steel Co. and of the Lake Superior Corporation.

Morton B. Smith died in Brooklyn, N. Y., May 16, aged 73 years. He was head of the Morton B. Smith Co. and was generally recognized as the oldest metal dealer in New York. As a young man, he became associated with William D. Andrews, who had established a metal brokerage house in 1847. After several changes in title, as different parties entered, the firm finally became Morton B. Smith & Co., and was incorporated under the present name in 1899.

On May 2, William K. Pullis, of Toronto, a well known Northern Ontario prospector, was drowned in the rapids of the Nagagami River about 175 mi. west of Cochrane, Ont. He was camping by the river with E. King Dodds and C. W. Evans, of Toronto, and in company with Mr. Dodds undertook a canoe trip down the river. The canoe got into a cross current in the rapids and overturned. Mr. Pullis attempted to swim ashore, but was unable to do so and was carried away by the swift current, his companion who clung to the canoe saving himself with great difficulty. At last accounts the body had not been recovered.

SOCIETIES

Minnesota School of Mines—The Senior class, under the direction of Professor Peter Christiansen, has been visiting mines and mills at Leadville and elsewhere in Colorado.

American Electrochemical Society—At the recent annual meeting, the following officers were elected for the ensuing year: President, Francis A. J. Fitzgerald, Niagara Falls, N. Y. Secretary, Dr. Joseph W. Richards, South Bethlehem, Penn. Vice-presidents, G. A. Schluederberg, F. J. Tone, and W. H. Walker. Managers, W. D. Bancroft, Dr. Carl Hering and E. F. Roeber.

American Iron and Steel Institute—At the annual meeting of the Institute held in New York recently, retiring directors were re-elected for the ensuing three years. These are as follows: Edward Bailey, Harrisburg, Penn.; Joseph G. Butler, Jr., Youngstown, Ohio; E. A. S. Clarke, New York; William H. Donner, Philadelphia; Willis L. King, Pittsburgh; Samuel Mather, Cleveland; John A. Topping, New York.

Society of Chemical Industry—The latest meeting of the New York Section was a joint meeting with the New York sections of the American Chemical Society and of the American Electrochemical Society, at Rumford Hall, 50 East 41st St., May 19. The subject considered was: "Some Problems in the Petroleum Industry," by Raymond F. Bacon. As was expected the subject of the evening was discussed by those interested in it.

Colorado School of Mines — The trustees on May 11, appointed three new professors to the faculty. George J. Young, recently of the mining department of the University of Minnesota, will succeed F. W. Traphagen in the chair of metallurgy. Claude C. Van Nuys, of the South Dakota School of Mines, takes the chair of physics at present occupied by L. F. Miller. George C. Dolman, principal of the Monte Vista, Colo., high school, is the first appointed to the new chair of English and Foreign Languages. The Senior class is on its long tour but will reach Golden May 22. Commencement will occur Friday, May 26, the principal address to be delivered by James R. Finlay.

INDUSTRIAL NEWS

The Kalbperry Corporation has opened a new office in the Metropolis Building, 31 Union Square, New York, for the purpose of conducting business as chemical engineers.

The International Filter Co., of Chicago, builder of water-softening and filtration plants, has appointed Wilbur S. Wilding as Eastern representative in charge of the New York office, which is in the Woolworth Building, New York.

The Terry Steam Turbine Co., Hartford, Conn., has appointed O. E. Thomas, 626 Washington Building, Los Angeles, as its district sales manager, for a territory covering Arizona and the southern portions of California and Nevada.

Chas. L. Foster, formerly manager of the Akron District for the Westinghouse Electric & Manufacturing Co., has taken charge of the sales department of the Electric Furnace Co., of Alliance, Ohio. Mr. Foster has had a long experience in the electrical line, having been for 13 years with the Westinghouse company.

The Zinc Concentrating Co. has closed a contract with the Dings Electro-Magnetic Separator Co., of Milwaukee, taking over all the rights to that company's zinc-iron separators and all its outstanding contracts. The Zinc Concentrating Co. will operate both the Campbell separators and the Ding separators, in addition to the Etherington-Singer roaster.

The Quigley Furnace Specialties Co., No. 26 Cortlandt St., New York, will manufacture and deal in high-grade furnace materials, such as high temperature furnace cements, insulating brick, automatic fuel-oil valves, oil, gas and powdered coal burners and appliances, temperature and draft recording and controlling systems, gas analyzing instruments, etc.

The Consul General of Uruguay in New York informs us that the law of that country making it unlawful to circulate in Uruguay catalogs and other printed matter in which weights and measures other than those of the metric system are used, does not apply to catalogs issued by foreign firms and printed in foreign countries. Firms here can send such catalogs to Uruguay, but it must be shown that they were printed in the United States.

The H. Koppers Co., Pittsburgh, has under construction 640 byproduct coke ovens for the Carnegie Steel Co. at Clairton, Penn.; for the National Tube Co. 208 at Lorain, Ohio; 204 for the Youngstown Sheet and Tube Co. at Youngstown, Ohio; 94 for the Toledo Furnace Co. at Toledo, Ohio. Recent contracts include 180 byproduct ovens for the American Steel and Wire Co. at Cleveland, Ohio; 120 for the Colorado Fuel and Iron Co. at Pueblo, Colo.; and for a large plant for the Public Service Corporation of New Jersey.

TRADE CATALOGS

Clark Car Co., Pittsburgh, Penn. Catalog E9. Extension side dump cars. Illustrated, 12 pp., 4x9 in.

Scranton Pump Co., Scranton, Penn. Bulletin No. 107. Scranton Triplex Plunger Pumps. Illustrated, 12 pp., 6x9 in.

National Transit Pump and Machine Co., Oil City, Penn. Bulletin No. 302. Power Pumps. Illustrated, 16 pp., 6x9 in.

The Goulds Mfg. Co., Seneca Falls, N. Y. Bulletin No. 102. Single Acting Trunk Plunger Pumps. Illustrated, 16 pp., 8x10 in.

Stow Mfg. Co., Binghamton, N. Y. Booklet. "Portable Tools of Proven Value." Drills, Grinders, etc. Illustrated, 20 pp., 3½x6 in.

Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3029. Ingersoll-Rogler Class ORC Duplex Corliss Steam Driven Air Compressors. Illustrated, 32 pp., 6x9 in. Form No. 3036. Turbo Blowers. Illustrated, 10 pp., 6x9 in. Form No. 4120. Leyner-Ingersoll Water Drills. Illustrated, 44 pp., 6x9 in.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

AGGLOMERATING—Art of Agglomerating Ores. James H. Payne, Baltimore, Md. (U. S. No. 1,181,244; May 2, 1916.)

ANNEALING FURNACE or Leer. Lewis Steelman, Millville, N. J. (U. S. Nos. 1,178,549 and 1,178,550; Apr. 11, 1916.)

COMPOUND METAL BODIES, Process of Producing. Otto H. de Lapotterie, Koppel, Penn. (U. S. Nos. 1,180,248 and 1,180,249; Apr. 18, 1916.)

COPPER—Process of Extracting Copper from Its Ores. William E. Greenawalt, Denver, Colo. (U. S. No. 1,180,844; Apr. 25, 1916.)

CRUSHING—Fastening Means for Crushing-Rolls. Jesse Goff, Webb City, Mo., assignor of one-half to Daniel F. Butler, of Webb City, Mo. (U. S. No. 1,181,304; May 2, 1916.)

CRUSHING—Grinding Plate for Mills. Joseph H. Heishman, Port Huron, Mich. (U. S. No. 1,179,429; Apr. 18, 1916.)

CRUSHING—Stamp Mill. Edward H. Moyle, Los Angeles, Calif. (U. S. No. 1,181,535; May 2, 1916.)

CRUSHING—Stamp Mill. Frederick Bassett, Philipsburg, Mont. (U. S. No. 1,183,521; May 16, 1916.)

CRUSHING — Tube Mill. David E. Carlson, Chicago Heights, Ill., assignor to Chalmers & Williams, Inc., Chicago Heights, Ill. (U. S. No. 1,183,431; May 16, 1916.)

CYANIDING—Process of Cyaniding. Harai R. Layng, Seneca, Calif. (U. S. No. 1,183,086; May 16, 1916.)

DEWATERING—Means for Simultaneously Conveying and Dewatering Material. Hugh B. Lowden, Denver, Colo., assignor to Colorado Iron Works Co., Denver, Colo. (U. S. No. 1,181,022; Apr. 25, 1916.)

DRILL-SHARPENING MACHINE. Charles Christiansen, Gelsenkirchen, Germany. (U. S. No. 1,180,570; Apr. 25, 1916.)

DRILLING—Rock-Drill Cradle. James Howard Vivian, Johannesburg, Transvaal, South Africa, assignor to Holman Brothers, Ltd., Camborne, England. (U. S. No. 1,179,782; Apr. 18, 1916.)

DRILLS—Dust-Collector for Drills. Frank F. Riggs, Lead, S. D. (U. S. No. 1,181,925; May 2, 1916.)

DRILLS—Improvements in Connection with Rock Drills and the Like. M. T. Taylor and D. A. Loring, Cornwall, Eng. (Brit. No. 1,862 of 1915.)

DUST SEPARATOR or Grader. William S. Osborne, Canton, Ohio, assignor to the Bonnot Co., Canton, Ohio. (U. S. No. 1,182,413; May 9, 1916.)

ELECTROLYTIC APPARATUS. William E. Greenawalt, Denver, Colo. (U. S. No. 1,183,188; May 16, 1916.)

EXCAVATOR. Peter Gavin, Kamloops, B. C. (U. S. No. 1,180,288; Apr. 25, 1916.)

FLOTATION—Copper Precipitant. Henry Livingstone Sulman and Hugh Fitzalis Kirkpatrick Picard, London, England, assignors to Minerals Separation American Syndicate (1913) Ltd., London, England. (U. S. No. 1,178,191; Apr. 4, 1916.)

FLOTATION of Minerals. Raymond F. Bacon, Pittsburgh, Penn., assignor, by mesne assignments, to Metals Recovery Co. (U. S. No. 1,180,816; Apr. 25, 1916.)

FLOTATION—Ore-Flotation Apparatus. John M. Callow, Salt Lake City, Utah, assignor to Metals Recovery Co., Augusta, Me. (U. S. No. 1,182,748; May 9, 1916.)

FLOTATION—Process and Apparatus for Separation of Ores by Flotation. Albert W. Thompson, Fitchburg, Mass., and David Cole, El Paso, Tex.; said Thompson assignor to G. M. Parks Co., Fitchburg, Mass. (U. S. No. 1,180,089; Apr. 18, 1916.)

GOLD SEPARATOR. Jerome W. Sweet, Half Moon Bay, Calif. (U. S. No. 1,181,695; May 2, 1916.)

LAMP—Acetylene Lamp. Augie L. Hensen, Chicago, Ill., assignor to Justrite Manufacturing Co., Chicago, Ill. (U. S. No. 1,180,492; Apr. 25, 1916.)

LIMESTONE—Process of Calcining Limestone. Rea Hart, Rockford, Ill., assignor to Rea Hart and Bailey B. Page, Copartners doing business as Hart & Page, Rockford, Ill. (U. S. No. 1,179,180; Apr. 11, 1916.)

MINE DOOR. Andrew J. Johnson and Peter Blessant, Stonington, Ill. (U. S. No. 1,179,321; Apr. 11, 1916.)

ORE TREATMENT — Process of Treating Ores Bearing Precious Metals. Edward R. Holden, Los Angeles, Calif. (U. S. No. 1,181,077; Apr. 25, 1916.)

RADIUM—Extraction of Radium from Carnotite Ores, Etc. Herman Schlundt, Columbia, Mo. (U. S. No. 1,181,411; May 2, 1916.)

ROASTING of Sulphur-Bearing Ores. Harry H. Stout, New York, N. Y., assignor to General Chemical Co., New York, N. Y., a Corporation of New York. (U. S. Nos. 1,181,183 and 1,181,184; May 2, 1916.)

SEPARATOR—Ore Separator. Edward R. Holden, New York, N. Y. (U. S. No. 1,181,666; May 2, 1916.)

STEEL—Alloyed Steel. James Churchward, Mt. Vernon, N. Y., assignor to Churchward International Steel Co., New York, N. Y. (U. S. No. 1,181,570; May 2, 1916.)

TIN—Apparatus for Preparing Tinned Boxes and the Like for Detinning. Philipp Gensheimer, Elizabeth, N. J., assignor to Goldschmidt Detinning Co., New York, N. Y. (U. S. No. 1,181,660; May 2, 1916.)

ZINC—Extraction of Zinc from Its Ores or Products. Henry Thomas Durant, London, England, assignor to The Metals Extraction Corporation Ltd., London, England. (U. S. No. 1,180,765; Apr. 25, 1916.)

Editorial Correspondence

SAN FRANCISCO—May 17

Robbery of Illingworth & Dunnel at Randsburg on May 10 of about $20,000 in cash was probably inevitable. Randsburg and Atolia have for the last year been the scene of tungsten-mining operations in which large amounts of money have been accumulated by prospectors and miners who have discovered or operated tungsten deposits on leases. Illingworth & Dunnel deal in merchandise, having one of the largest stores in the Randsburg region, but the firm is also engaged in mining, buying and selling mines, grubstaking prospectors and leasers, and does a depository business for the accommodation of their numerous customers. The firm has a reputation for integrity and fair dealing and has been like a bank in the absence of such an institution, and it was known, by everybody who was acquainted with the commercial and financial situation in the region, to carry large amounts of money in safe-deposit boxes. It is the history of all boom mining camps that thieves of various caliber are always among the list of camp followers. There is little doubt that the robbery was committed by professional yeggmen who probably felt particularly safe because the camp is isolated, being 100 mi. from Bakersfield, the county seat. Telegraph communication was immediately directed to the sheriff, and the Pinkertons at Los Angeles were also notified. But thieves with an automobile might easily make their escape by way of Mojave, Kramer, or San Bernardino and get out of the country by way of Los Angeles or San Francisco. Illingworth & Dunnel, the Yellow Astor store and Wells, Fargo & Co. at Randsburg and the Teagle store at Johannesburg all handle large amounts of money. There is no bank and there has never been felt the need of a bank. It is possible that the robbery will now convince the people of this region that a bank with a strong vault is one of the necessary adjuncts to the safety of valuables in the camp.

DENVER—May 19

Colorado Fuel and Iron Co. fired up its furnace A, May 17; this is the largest blast furnace in the West, and gives some indication of the expanding demand for iron and steel in the intermountain country.

United States Reduction and Refining Co.'s Mills and other properties in El Paso, Teller and Fremont Counties have been purchased in bankruptcy by Spencer Penrose, of Colorado Springs, for $100,000. It is probable that the Standard mill at Colorado City and the U. S. mill at Florence will be immediately dismantled.

Chemical Products Co. is the title of a Denver concern in which Lafayette Hughes and R. V. Barkalow are prominent factors. An old property formerly used as a paper mill has been reëquipped with modern metallurgical and industrial-chemical apparatus. Although much local curiosity has been aroused by the secrecy with which the research and the operations have been conducted, it is a fact that the company, among other things, is manufacturing barium oxide which it utilizes in the manufacture of hydrogen peroxide. The company is pushing research along numerous lines and is preparing to produce chemicals that were rendered scarce by the European War. It will also mine its raw materials.

BUTTE—May 17

Tunneling the Main Range of mountains east of Butte has long been a favorite dream of Butte promoters. Promising showings have been opened along the continental divide and many mining men and geologists have held to the belief that rich copper deposits might be found. Actual work has finally been started on the tunnel project by a company known as the Butte-Columbia Mining Co. The portal will be a short distance south and east of the Butte-Duluth property and the plans are to drive it a distance of 3,700 ft. into the mountain at a depth of about 1,500 ft. The promoters believe they will find ore, and in any event count on making a profit from the water they will doubtless drain from the mountain.

Butte-Duluth Bondholders will make an effort to save the property by bidding it in at a receiver's sale. They have received permission from the district court to intervene in a creditors' suit against the receiver, in which the court had directed the receiver to sell so much of the property as would be found necessary to pay off the labor liens and claims of supply men. The intervention of the bondholders served to postpone the ordered sale, and they are asking that the bond mortgage ($500,000) be made a prior lien on all the property and that the bondholders be permitted to buy the property at the receiver's sale. In doing so they would assume the other debts of the company. What plans they have, if any, for raising the necessary funds, is not made public. Captain Wolvin, the manager and chief owner of the company, is in New York, having left Butte when the financial storm wrecked the company. His friends say he has been endeavoring to raise funds for refinancing and that he has been meeting with some success. The failure of Butte-Duluth caught an unusually large number of local investors, many of whom backed the company and took convertible bonds. Most of the bonds held locally were converted into stock just before the crash came, and the stock, of course, has little or no value now, it being very doubtful that the property can be sold for enough to pay the outstanding bonds. The Butte-Duluth owns a considerable acreage, on the east side of the district, containing a large tonnage of low-grade copper ore, running from one to four per cent., and a leaching and electrolytic precipitation plant. Operations were continued through the worst period of the war depression, and it was claimed that the company was turning out copper at a cost of 7c. per lb., but the stories were received rather skeptically by mining men. Anaconda and others had options on the property, but after examinations and investigations forfeited them.

SALT LAKE CITY—May 18

Potash and Glauber Salts Are Being Extracted from the water of Great Salt Lake by the Utah Chemical Co., a subsidiary of the Diamond Match Co. Construction work on the factory situated near the shores of Great Salt Lake not far from this city was begun late in 1915, and carried to completion during the winter. Operation began the end of April. The product is being shipped to Chicago, and from there in part sent as fertilizer to cotton states in the South.

Eighteen Utah Mines appear in a list showing those American mines, whose dividend payments have equaled or more than equaled the amount of capitalization. In most cases the total of dividends far exceeded capitalization. The Utah mines in the list are: Beck Tunnel, Bullion Beck & Champion, Centennial-Eureka, Colorado, Consolidated Mercur, Daly-Judge, Quincy, Gemini-Keystone, Daly West, Grand Central, Iron Blossom, May Day, Ophir, Silver King Consolidated, Silver King Coalition, Sioux Consolidated, Utah Consolidated and Utah Copper. In April of this year 10 Utah mines paid dividends aggregating $867,258.

The Holt-Christensen Process Co. filed articles of incorporation May 17. This is the interesting outcome of a technical development already described in the "Journal" columns. The company is organized to deal in and operate plants for the treatment and reduction of ores for which it holds 10 United States patents, which are made the basis of a $10,000 capitalization, divided into 100,000 shares, par value 10c. Provo is the principal place of business. Officers and directors are: Jesse Knight, president; George H. Dern, vice-president; W. L. Mangum, secretary-treasurer; T. P. Holt and J. William Knight.

More Utah Mines Are Being Operated and shipping, and a larger tonnage is being treated at the smelteries in Salt Lake Valley than in years. All of the smelting plants are working at capacity, and a large quantity of ore, especially sulphides has been stockpiled. Much lead ore has been received. It is impossible to treat more than a certain amount, on account of the limited roasting capacity and the restrictions regarding the amount of sulphur fumes that are allowed to escape. One of the lead smelters has accumulated enough ore to run three months without purchasing any further supply. In the near future shippers without contracts may have difficulty in disposing of their output. The aggregate smelting capacity of the local lead plants is approximately 3,000 tons daily. The market for copper ores is good, and material of this character is being freely taken. The copper-smelting capacity of the different plants is about 5,000 tons daily. There has been a moderate tonnage of tungsten ores shipped through Salt Lake in the last six months, from Nevada, Utah and Idaho, but there has not been so much tungsten shipped as commonly supposed; the large amount of newspaper publicity has ap-

parently had some effect in scaring buyers in the East in regard to over-production, so that at present there is practically no market. Antimony ores are in good demand, and material of this character is being handled from southern Utah, Nevada and Idaho. There is practically no market for uranium and vanadium ores at present. The National Radium Institute at Denver has bought a small amount of ore from around Green River, at comparatively low prices. However, assessment work on uranium and vanadium claims is being done in some cases.

SEATTLE, WASH.—May 18

The Output of Fairbanks District for 1916, it is now generally estimated, will be $1,000,000 more than in the season of 1915. R. C. Wood, president of the First National Bank at Fairbanks, places the estimated output at $4,450,000, and this bank's estimate is generally accepted in the North where its predictions for several years have been borne out by final statistics. Figures gathered from the banking company's field force, showing estimated yield from the various creeks of the Fairbanks district for this year, are as follows: Chatanika, Cleary, Wolf and Chatham Creeks, $550,000; Fairbanks Creek, Crane Gulch and tributaries, $200,000; Little Eldorado Creek, $120,000; Dome Creek, $160,000; Vault Creek, $50,000; Pedro Creek, $20,000; Goldstream Creek, $325,000; Gilmore Creek, $50,000; Ester, Gold Hill, Happy and St. Patrick Creeks, $375,000; Smallwood Creek, Big Eldorado, Fish and tributaries, $75,000; Quartz Creek and quartz production, $50,000; Tenderfoot Creek, etc., $200,000; Hot Springs, $1,000,000; Tolovana district, $700,000; antimony, tungsten and other ores, $400,000; total, $4,455,000.

JUNEAU, ALASKA—May 10

Much Diamond Drilling is being done in the Juneau gold belt. The horizontal hole being drilled by Lynch Bros. from the face of the 2,250-ft. tunnel of the Alaska Gold Belt Co., near Juneau, recently reached 1,680 ft., which is a record for the North country, if not a world's record. Some years ago the Alaska Treadwell Gold Mining Co. drilled a horizontal hole about 1,200 ft., accomplished, by the way, with the same drill—a Sullivan "Champion"—which has a rating of only 1,500 ft. on vertical holes. It is thus seen that the 1,680-ft. hole on the Gold Belt property far exceeds the capacity of the drill as recommended by the manufacturers. The severe duty required of the drill is shown by the fact that it used all the air from a 6-drill compressor to turn the rod, whereas under normal condition this equipment requires approximately the same amount of air as a large piston drill. Lynch Bros. are understood to have a contract to drill another long hole from close to the portal of the tunnel, in a downward direction, to prospect the ground below. It is reported that the Gould & Curry orebody was cut by the first diamond-drill hole, and that tunneling will be resumed in the near future, under the direction of A. B. Dodd, managing director, to continue the development of this company's claims. Lynch Bros., of Juneau, have also obtained a contract for from 4,000 to 9,000 ft. of drilling, practically in the town of Douglas. It is understood that R. A. Kinzie, former superintendent of the Treadwell company, is to be in charge for Eastern men. If results of the prospecting are as expected, it may mean operations fully as large as the Treadwell and will result in a boom for the town of Douglas. Other core drilling is to be done in this district for the Alaska Road Commission; John Zug, assistant engineer, has asked for bids for core-drill work to ascertain the formation and condition at points across Gastineau channel for a bridge foundation. This work calls for twelve holes through overburden to bedrock. The bridge will connect Douglas, Treadwell, Juneau and Thane for pedestrian and vehicle traffic, thus eliminating the use of boats and ferries for intercourse between these communities.

PHOENIX, ARIZ.—May 18

Tungsten Ores Are Being Mined in four counties in Arizona: Yavapai, Pima, Cochise and Mohave. Probably the greatest activity is in Yavapai County; practically all the tungsten mining in this county is confined to the Eureka, Tip Top and Tule Creek districts, as described in the "Journal" of Apr. 15. In Pima county, the only tungsten mining of importance is in Las Guijas district, southwest of Tucson. The principal shipper from this district is the International Tungsten Co., operating a 20-stamp mill, which will be added to as production demands. Robert O. Boykin recently shipped 8,640 lb. of tungsten ore, worth about $6,180, which was milled with a portable plant from ores of Las Guijas district. The Cochise County tungsten camps are particularly active. The concentrator at the Primos camp is being run day and night; about 15 tons of high-grade concentrates are made weekly and shipped to the company's refinery at Primos, Penn. Many individuals are also making good profits. In the Draper camp, several new tungsten properties are being opened. Seventy-five men are working dry placers in Sebring camp. From the Little Dragoon Mountains, ore is being regularly freighted to Benson for shipment. There are rich deposits of scheelite and hübnerite at Russellville, four miles north of Dragoon. The Johnson district is also augmenting its output. In Mohave County, the Yucca Tungsten Mining Co., at Yucca, has completed a 25-ton concentrator and about 40 men are employed. The Williams Tungsten Co., also of Yucca, is considering the installation of a mill. L. L. Stevens has a few men in the Aquarius Mountains, making a tungsten concentrate, which he hauls to Kingman. A 60% concentrate is being made in Boulder Cañon from lode claims and placer ground. At Cedar Valley, the Admaier Mining Co., is working 20 men on a wolframite vein and is operating a 25-ton mill.

OATMAN, ARIZ.—May 17

Important Changes in Tom Reed management have taken place following the annual meeting. S. S. Jones has resigned as general manager and has been succeeded by Edward W. Rabb, formerly at the Tennessee zinc mine at Chloride; Ellis Mallory will also join the Tom Reed staff. Changes in the directorate are: Charles N. Post, T. L. Auten and W. B. Cord succeeding E. R. Bradley, W. C. Mason and John Sprague. It is understood that W. P. Mooredyke may be elected president to succeed Charles Grimes. About 25 companies are now operating in the Black Range section, 5 mi. from heart of Oatman. The recent strike of the Black Range company has increased interest in this part of the district.

JOPLIN—May 20

Randolph D. Talmadge, a mine owner of Joplin, has been appointed field aid for this district to assist in obtaining the proposed industrial census of the United States in the interest of preparedness. Mr. Talmadge hopes to complete the census by June 1. Local operators are helping the work as much as possible.

Not a Single Bid For Ore was made last week in the Oklahoma section of the district on account of the slump in the spelter market, which put several smelting companies out of the local ore market. The Oklahoma field has become a heavy producer and it is predicted that it will soon pass the Joplin division and come next to the Webb City-Carterville camp in point of production. The ore, however, is not so high grade as in the Joplin camp and the section consequently suffers more under a poor market.

ISHPEMING, MICH.—May 20

Wages Again Advanced in this district by the Cleveland-Cliffs Iron Co. The increase was effective May 1, the action following the advance by the Oliver Iron Mining Co. Other companies on the iron ranges are also increasing the pay of the men.

The Record for a Single Day's Loading was broken on May 16 at the Marquette docks of the Lake Superior & Ishpeming Ry. A total of 43,000 tons of iron ore was placed in the holds of boats; the former record was 42,300 tons. Shipments are heavier from the Marquette docks than for some years past but there has been a falling off in shipments from the Escanaba docks.

No Change in Mine Valuations is expected as a result of the tax conference between the mine managers and members of the State Tax Commission. The mine owners are complaining more about the system in vogue for determining valuations than they are about their assessments. One point brought before the commission that had never been mentioned at a previous tax gathering was that if mine valuations in the Michigan field are reduced, other local property should also be lowered, as all property is dependent upon the iron-mining industry. The mine managers urged this point and it met with the approval of the commission.

TORONTO—May 19

The Canadian Tax Bill, under which mining and other companies are taxed 25% on excess profits, subject to liberal allowances for exhaustion of ore, has passed its final stages and is now a law.

The Calgary Oil Field has not attracted much general attention since the boom of two years ago. However, development has been going on steadily on some of the locations and at least three wells, the Dingman, Prudential and Southern Alberta, have oil in commercial quantities. At the Dingman a reduction plant has been installed and is expected to be in operation by the end of the month. It has been built so that additional units can be installed if required and is planned so that the wet gas which the well produces can be converted into gasoline without any separate operation. Tankage is available for the storage of oil which may be sent from other wells for refining. The Prudential is installing a new pumping plant, tests made some time ago indicating that it will prove a good pumping well.

The Mining News

ARIZONA

Gila County

GREATER MIAMI COPPER CO. (Miami)—Incorporated to develop group of 20 claims on Mineral Creek, formerly belonging to W. R. Jones and Grover Sikes; several carloads copper-silver-gold ore on dump. N. E. Milford, secretary.

Mohave County

JOHN WALKER discovered high-grade gold quartz on surface in Wallapai valley; others entering district.

TENNESSEE (Chloride)—Rich ore struck on 1,400-ft. level.

SCHUYLKILL (Chloride)—Now being unwatered; shaft will be deepened from 500- to 1,000 ft.

GOOD LUCK (Chloride)—E. J. Scott and G. H. Hadley have taken over nine claims lying between Schuylkill, Tennessee and Schenectady.

IVANHOE (Oatman)—Crosscut now in 216 ft. on 500-ft. level.

BLUE BIRD (Oatman)—New equipment installed; shaft down 120 ft.

LUCKY SAM (Oatman)—Shaft, down 175 ft., has encountered vein.

TIMES (Oatman)—Drifting on 20-ft. vein in Martin tunnel workings, from which good assay was obtained.

BLACK RANGE (Oatman)—Encountered 40-ft. vein at 300-ft. level; no official assay yet reported.

OATMAN UNITED (Oatman)—Headframe completed; small hoist being used temporarily, awaiting arrival of 40-hp. Fairbanks-Morse engine.

SUNSET AND INDEPENDENCE (Oatman)—H. S. Walker and other Colorado investors have formed new company to take over Sunset and Independence groups. Development already under way.

MOHAWK CENTRAL (Oatman)—M. J. Monnette, of Hayes-Monnette lease fame, in Goldfield, associated with G. W. Long, manager of United Eastern, John A. Hassell and J. P. Loftus, of Nevada, taken large interest. Plan more equipment and speedy development. Mohawk group adjoins Tom Reed and lies between United Eastern and Oatman United.

PAY DAY (Kingman)—Excitement aroused here by strike of rich gold quartz in Pay Day mine, 70 mi. northeast of Kingman. In one day over 20 wagonloads of "stampeders" left Kingman for scene of strike.

Pinal County

MAGMA (Superior)—Construction of 100-ton zinc concentrator commenced; entirely separate from copper concentrator; contract let for sinking main shaft from 1,200 to 1,600 level.

RAY HERCULES (Ray)—Last drill hole passed through 80 ft. of 3% copper ore. Concentrator with initial capacity of 1,000 tons being considered. George O. Bradley may design mill; J. M. Callow, consulting metallurgist.

AMERICAN SMELTING AND REFINING (Hayden)—Excavation for a third reverberatory furnace and other machinery, which will increase capacity of works 30%, practically completed. Reconstruction of sampling mill, destroyed by fire Apr. 8, nearly finished. Company plans to erect $20,000 recreation building, including gymnasium and swimming pool. Twenty brick cottages for employees being constructed.

Yavapai County

FURLOUGH DEVELOPMENT (Wickenburg)—New York men organized company to develop copper property. Will begin sinking 1,000-ft. shaft at once; George Holder, superintendent.

COPPER CHIEF (Clarkdale)—Mill treating 130 tons $8 gold ore; shipping 30 tons copper ore daily to Humboldt smeltery. Mine yields gold for first 250 ft.; sulphides for next 400 ft.; shaft only 650 ft. deep.

JEROME-SUPERIOR COPPER (Jerome)—New organization, in which employees and officers of United Verde are interested, will develop about 60 claims, lying south and east of the Arkansas & Arizona and North Verde, originally located by Sutliffe & Stanridge. Organizers include R. D. Tally, mine superintendent for United Verde; Thomas Taylor, smeltery superintendent; J. J. Stanton, master mechanic; Leroy Anderson, counsel; and others.

CONSOLIDATED ARIZONA SMELTING (Humboldt)—In first quarter, 1916, Blue Bell and De Soto mines produced 25,618 tons; concentrator treated 19,369 tons; smelting plant treated (custom material included) 20,842 tons; copper production, 1,691,000 lb.; silver, 21,903 oz.; gold, 905 oz. Net profits, $160,478, of which $78,395 were made in March. Operations during January and February seriously interfered with by weather conditions that made it impossible to maintain regular shipments.

CALIFORNIA

Amador County

BUNKER HILL (Amador City)—The 120th consecutive monthly dividend was declared payable May 15. Good grade of ore being extracted from the lower levels. E. Hampton is superintendent.

PLYMOUTH CONSOLIDATED (Plymouth)—Preliminary statement of James F. Parks, superintendent, of production and costs in April, 1916: Ore milled, 11,000 tons; total value, $59,900; working expense, $27,136; development expense, $4,188; surplus, $28,576; other capital expenditures, $4,273.

CONSOLIDATED AMADOR (Sutter Creek)—Hoist to be used for installing the three pumps for unwatering the shaft is about ready for operation and pumps are on the ground. Foundations for machinery are being laid and supplies of timber and steel are arriving. Transformer installation completed. Work shop erected. New steel headframe will be installed when preliminary work is completed. T. Walter Beam, manager.

Calaveras County

AMERICAN GOLD DREDGING CO. (Comanche)—Installation on Mokelumne River of third dredge said to have been arranged. This company succeeded Oro Water Light and Power Co. of Oroville.

Inyo County

ANTIMONY ORE reported in the Argus range, 20 mi. southeast of Darwin, on the rim of Panamint Valley, near the pass where the Ballarat-Trona road crosses range. Located by Ralph Williams and George Johnson and optioned to R. W. Moore and H. P. Russell, of Bishop.

TUNGSTEN PROSPECTS, east of Bishop, still attracting attention of prospectors and investors. Strikes reported on ground owned by Dr. Robert O'Neal and others of Bishop; this is just west of the Tungsten Mines ground. Only traces of tungsten were visible in outcrop but high-grade ore disclosed at shallow depth. Willis tungsten claims in Shannon Cañon, 10 mi. south of Bishop, optioned to Charles W. Alvord, of Bakersfield.

Shasta County

NOBLE ELECTRIC (Heroult)—Smeltery run for three weeks with one furnace and reported to have produced ferromanganese at rate of 12 tons per 24 hr. Second furnace will be in operation about end of May.

GUGGENHEIM INTERESTS reported to be making examination of dredging ground on the Bassett, Van Balveren, Mark and Patterson farms, embracing about 1,000 acres. Keystone drill being used to prospect Bassett farm near Sacramento River.

DREDGING GROUND, owned by William Diestlehorst, embracing 160 acres on Clear Creek, reported bonded to El Oro company of Yreka. Prospecting being done by shafts. Diestlehorst has operated small dredge of his own design several years.

ASBESTOS reported ready for shipment from Sims. The deposits are situated on Mears Creek and owned by J. J. Hartigan, of Castella and H. T. Mecum. Operation is in western part of Shasta County, but in district separate from the asbestos mines in Trinity County.

COLORADO

Boulder County

ANNA L. (Boulder Falls)—Shaft down 100 ft. and 150 ft. of drifting done in ore.

BRACE (Nederland)—Twelve sets of lessees at work on this property, recently acquired by Degge & Clark.

WHITE RAVEN (Boulder)—Being developed by L. A. Ewing & Co. Shaft down 400 ft. High-grade silver-lead ore being shipped.

LOGAN (Crisman)—Sale to Boulder and Kansas men reported; mine is gold and silver producer, and recently tungsten was found.

SPRADLEY (Camp Loveland)—Being developed by W. T. Branson. Shaft down 100 ft. and station is being cut preparatory to drifting both ways on rich tungsten vein.

WILD TIGER (Boulder Falls)—Vigorous development is under way at this property, owned by C. M. McAllister, of Boulder. An 8-drill compressor purchased and exploratory tunnels will be driven. A Temple electric drill will be tried.

Chaffee County

MONARCH-MADONNA (Monarch)—Fred Watson, miner, was killed May 17, when he fell 200 ft. in shaft No. 6.

San Juan County

SHIPMENTS FROM SILVERTON during April were: Silver Lake, 78 cars; Sunnyside, 36 cars; Iowa-Tiger, 22 cars; Dives Leasing Co., 3 cars; D. McLean, 2 cars; N. C. Maxwell & Co., King Bros. & Co. and A. Jackson, 1 car each; miscellaneous shipments, 2 cars; total, 146 cars.

San Miguel County

BALLARD (Telluride)—Operations resumed by Anderson and Lacey, lessees; mill in Bear Creek Gulch in operation.

CONCENTRATES SHIPMENTS from Telluride during April were: Tomboy, 52 cars; Smuggler-Union, 50 cars, of which 30 were shipped to Durango and 20 to Blende; Liberty Bell, 15 cars; total, 117 cars.

FAVORITE MINES AND REDUCTION CO. (Telluride)—This new company incorporated by Philip L. Foster, William D. Thornton and D. A. Herron has commenced active development on Favorite mine at Ophir. D. A. Herron, manager.

Summit County

MILLING CAPACITY in Breckenridge district being increased. Puzzle 50-ton mill nearing completion; gravity and flotation concentration used. Ball mill and electric separators added to Old Union mill equipment. Jessie mill overhauled and enlarged; now ready for operation.

EXCELSIOR (Frisco)—Regular shipments lead-zinc ore being made by lessees.

JUMBO (Montezuma)—Zeeka Heilman, machineman, instantly killed, Apr. 31, by fall of rock in stope.

DUNKIN (Breckenridge)—Development work on this Nigger Hill mine under way. Shipments of gold ore being made.

WELLINGTON (Breckenridge)—In spite of bad roads, 50 tons concentrates per day being shipped. Production to be doubled soon.

OLD UNION (Breckenridge)—New shoot of lead-silver ore opened while retimbering old crosscut tunnel. Mill treating ore from Old Union and Country Boy.

WASHINGTON (Breckenridge)—First car of concentrates shipped recently to Chamberlain sampling plant. Much development under way. New shoot of lead-silver ore, carrying some gold, opened. Increase in mill equipment contemplated.

IDAHO

Bonner County

IDAHO-CONTINENTAL (Porthill)—Completing 300-ton concentrating mill on site of mill destroyed by fire. Recently shipped two cars of sorted lead-silver ore.

Custer County

LOST PACKER (Bonanza)—This copper-gold property, owned in Salt Lake City, is being reopened for the season by Manager John P. Boyle.

Owyhee County

SOUTH MOUNTAIN (Silver City)—Reported that Stanly A. Easton and associates, of Wallace, will develop this old copper-lead-silver-zinc property, comprising 16 claims. Golconda tunnel will be cleaned out and development started at once.

Shoshone County

BASIN (Burke)—Control taken by Hercules Mining Co. of these five claims adjoining its property on south.

INDEX (Wallace)—Crosscut tunnel to develop this group at 500-ft. depth now in 250 ft. Henry Gilbert, manager.

RAY-JEFFERSON (Wallace)—This company, building 250-ton mill, now controlled by Day interests and output will be shipped to Northport, Wash., for smelting.

BOSS ZINC (Osburn)—Development of this zinc-lead-silver prospect on east fork of Two-Mile Creek, will be undertaken. Control optioned to Lieb Bros., brokers, of Wallace.

HYPOTHEEK (Kingston)—New electric hoist and headframe in place, and mill practically completed. Orebody opened on 500-, 700- and 900-ft. levels; exploration on 1,100 level, east and west, encountering ore.

MICHIGAN

Copper

TREMONT DEVON (Ontonagon)—Sinking third drill hole.

LAKE (Lake Mine)—Shipping about 300 tons daily to Baltic mill.

AHMEEK (Ahmeek)—By end of June, eight stamp heads should be ready to run; expected to handle 5,600 tons daily.

FRANKLIN (Demmon)—Second shaft being opened; month or more necessary to do required cleaning and retimbering.

NEW ARCADIAN (Houghton)—Mill run of New Arcadian's additional stockpile will be made as soon as Franklin mill can spare the heads.

NEW BALTIC (Houghton)—At 1,230 ft., drill cut the conglomerate, showing 8 ft. well mineralized; concludes diamond-drill explorations, as the dip and trend of all formations are now laid out. Plans shaft at south end of property, to open New Arcadian lode and the conglomerate.

MOHAWK (Mohawk)—Purchased 900 acres of Torch Lake shore land with a mile running over to Portage Lake, from Roebling interests; gives good dockage on Portage Lake and a good mill site on Torch Lake, practically opposite Quincy stamp mill. No present intention of erecting another mill.

COPPER RANGE CONSOLIDATED (Painesdale)—Champion rock running 37 lb. copper per ton at present; better than average for last year, which was considered remarkable record. Baltic and Trimountain maintaining tonnages and grade, Baltic running over 31 lb. The lower openings are average rock in each case; slight improvement noticeable in Trimountain. Preparations for rebuilding Trimountain stamp mill proceeding but construction will not be rushed; present mills are able to care for output and Trimountain mill is to be rebuilt to provide for emergency.

Iron

ODGERS (Crystal Falls)—Some ore now being shipped; 25 cottages to be erected.

AUSTIN (Gwinn)—Reopened after nearly two years' idleness. Three other mines, Stephenson, Stegmiller and Gwinn, now working in Gwinn district.

FORTUNE LAKE (Crystal Falls)—Winston Bros., who have contract to divert Briar Hill Creek water from this orebody, will use dragline excavators; 15 houses being erected.

MINNESOTA

Mesabi Range

UTICA (Hibbing)—Steel headframe now being erected.

ORDEAN (Virginia)—Two shovels cleaning up surface of orebody. Pit ready to ship any time.

HELMER (Buhl)—This Minnesota state-lease mine, operated by Swallow & Hopkins, is shipping.

MISSABE MOUNTAIN (Virginia)—Twelve drills doing further exploration to obtain information for stripping. One shovel removing ore from pit.

HULL-RUST (Hibbing)—Seven shovels are in Hull-Rust pit. All loading ore except one or two which encountered some overburden among old caves.

PHILBIN (Hibbing)—Improvements at this underground mine are practically completed. Pump room installed. Extension to engine house and change house also completed.

ALPENA (Virginia)—Shipping from stockpile occasionally. Three underground workings now in operation; ore from two hoisted through shaft, and the other dumps from side of hill into pocket.

HILL ANNEX (Calumet)—A. Guthrie & Co. stripping for Great Northern Iron Ore Properties. Three shovels in operation; two features of present work are use of Gordon spreader to level dump, and power track lifter.

MISSOURI

Joplin District

ADIRONDACK (Joplin)—Building new mill on Fairview cemetery lease; mill burned two years ago.

ANDREWS BROS. (Galena)—Let contract for mill on Martin land, following drilling; shaft well under way.

EDWARDS LAND (Joplin)—Six new shafts going down, following drilling campaign in which good strikes were made.

CHAUTAUQUA LAND (Carthage)—Being drained by Graves and associates and four companies are installing machinery to work.

J. A. HARDY (Joplin)—Purchased 307-acre tract northeast of Carterville, adjoining sheet-ground field, for $30,000, and will prospect.

JESSE BREIGLE (Joplin)—Let contract for 20,000 ft. of drilling on 1,000-acre lease recently acquired west and southwest of Webb City.

O. W. SPARKS (Joplin)—Started 300-ton mill on Schoolhouse lease of Missouri Lead and Zinc Co.'s land, in South Joplin, following four good drill strikes.

MONTANA

Deer Lodge County

ANACONDA (Anaconda)—Construction on several plants at Washoe Reduction Works approaching completion; zinc concentrator nearly finished and in copper department, installation of large Great Falls type converters now completed. About 24,500,000 lb. copper produced in April.

Lewis and Clark County

PORPHYRY DIKE (Rimini)—Anaconda has large force at work developing and testing property which covers about 250 acres. Lowest point of development now 250 ft. below surface. Values so far range from 5c. to $5 per ton in gold. Expected to average about $3 per ton, with mining and milling costs of $1 per ton. Plans call for opencut mining. There is 20-stamp mill on property.

Powell County

ARMILDA (Avon)—Rich ore, running from 12 to 25% in copper and from 2 to 5 oz. in gold, reported in this mine, owned by Helena-Scratch Gravel Mining Co.

Silver Bow County

DAVIS-DALY (Butte)—Quarter ended Mar. 31 shows receipts $42,540 from ore and $2,228 miscellaneous revenues; disbursements $39,981. New Nordberg hoist, with capacity of 1,100 tons in 16 hr., ordered for delivery in four months.

BUTTE & SUPERIOR (Butte)—Quarter ended Mar. 31 shows profits, $3,554,940. Mill recovery now about 93%. Company's monthly payroll, with nearly 2,000 men, is about $250,000 at present.

EAST BUTTE (Butte)—Results for May promise to be best for many months. There has been steady increase for two months both in tonnage and grade of ore, now above 4% copper. Output for April at Pittsmont smeltery, 1,501,000 lb. copper, an increase of 195,000 lb. over March.

BUTTE-BALLAKLAVA (Butte)—Case of Anton Donati and partners against company was dismissed May 11 by Judge Lynch. Partners had a month-to-month lease on 1,600 level of Ballaklava. They were made to quit without notice and sued for $6,000 damages. Court held that 30 days' notice not needed to end agreement of that kind.

ANACONDA (Butte)—At company's Emma mine, in residence district of Butte, surface improvements are being rushed to permit active exploitation of zinc and silver ores; new hoist will be in place and other machinery installed by July 1, when stoping will be started; crosscut from company's Gagnon mine on 1,500-ft. level is being pushed toward Emma with all possible speed to permit raising to meet Emma shaft. At company's Nettie mine, in western section of Butte district, ore was encountered in drift on 500 level. Ore is being blocked out and within 30 days company expects to ship ore high in silver to Washoe works. In years past, Nettie was one of Butte's famous producers of rich silver ores.

NEVADA

Clark County

YELLOW PINE (Goodsprings)—Now shipping about 1,800 tons of zinc concentrate and 250 tons of lead concentrate per month. New 75-hp. power plant just installed at mine. Dividend of $150,000 May 10 makes total paid in 1916 $350,000.

PRAIRIE FLOWER (Goodsprings)—Under bond to F. A. Hale and associates, who have force of men cleaning out old workings preparatory to further exploration. Adjoins Yellow Pine on north and has shipped considerable ore; idle last few years.

BOSS (Woodsprings)—Experimental plant erected for testing methods of treatment of copper-gold-platinum ore, of which there is a tonnage blocked in the mine. O. J. Fisk, general manager, announced that small plant, utilizing chloridizing roast, will be erected in the near future, this method having given satisfactory results in preliminary tests.

Elko County

STARLIGHT (Jarbidge)—Second tunnel started to explore vein at greater depth.

LONG HIKE (Jarbidge)—The interests holding bond on this property have optioned additional claims. Employing about 50 men.

BLUSTER CONSOLIDATED (Jarbidge)—Mill has started. Mine again being examined by engineers representing George Wingfield of Goldfield.

PHALAN MANGANESE (Shafter)—Faddis & Mitchell, of Salt Lake City, have leased this manganese mine and will haul 43 to 45% ore by motor truck to Western Pacific R.R.

Esmeralda County

FLORENCE GOLDFIELD (Goldfield)—Purchased flotation plant of Nevada Metal Extraction Co. and will at once add sufficient equipment to bring capacity up to 300 tons per day. The dumps, for treatment of which plant was erected by leasing company, revert to the Florence. Underground reserves estimated at 75,000 tons expected to yield a profit between $3 and $4 per ton when treated in enlarged plant.

JUMBO EXTENSION (Goldfield)—Preliminary estimate for April gives production at 2,721 dry tons, averaging $29.03 per ton, or a gross value of $79,000. Sampling, freight and treatment amounted to $28,500; smelting loss, $8,000; operating costs, $17,500; net profit, $25,000.

REORGANIZED BOOTH (Goldfield)—Dividend No. 4 declared payable June 6; disbursement of about $50,000; total since Mar. 6, 1916, almost $350,000, derived from proceeds from settlements of apex claims. Property not working; shaft dismantled and buildings removed.

RAY (Goldfield)—These copper claims, about 18 mi. southwesterly from Goldfield at the foot of Jackson Mountain, optioned for ex-Senator W. A. Clark, of Montana. Shaft being sunk to 300-ft. level, where first lateral development will be undertaken.

Humboldt County

RICH TUNGSTEN STRIKE reported by Ernest Gray, 15 mi. north of Golconda in the Hot Springs Range; claims 4-ft. vein carrying scheelite.

SPRINGER, LAMB & WHITE (Seven Troughs)—Tungsten find made near Eagle Rock, 16 mi. west.

NEVADA PACKARD (Lovelocks)—Precipitates, valued at $12,000, representing cleanup for last half of April, recently shipped to Selby.

BEESON (Lovelocks)—This tungsten property, 25 mi. southwest, is preparing to make 500-ton shipment. Haulage contract let to Broulet Bros., who will use 75-hp. Holt tractor and 6 trailers on 20-mi. haul to Marion, on Southern Pacific R.R. Mill to be built; Forbes Rickard, engineer, Equitable Bldg., Denver.

Nye County

TONOPAH ORE PRODUCTION for week ended May 13 was 9,001 tons, valued at $192,678, compared with 6,552 tons for week previous. Producers were: Tonopah Belmont, 3,031 tons; Tonopah Mining, 2,250 tons; Tonopah Extension, 1,850 tons; Jim Butler, 750 tons; West End, 305 tons; Rescue-Eula, 237 tons; Halifax, 153 tons; North Star, 70 tons; Cash Boy, 50 tons; MacNamara, 41 tons; miscellaneous, 264 tons.

GREENWATER COPPER (Tonopah)—This company, now developing Bonanza and Great Western properties in this district, has shaft down 1,470 ft. in the Bonanza and will continue sinking to at least 1,800 ft. Great Western shaft in ore-bearing formation at 1,150 ft. where 70-ft. crosscut has been driven, four pumps, with capacity of 300 gal. per min. installed to handle increased water flow. John McGee, manager.

Storey County

CON. VIRGINIA (Virginia)—South drift, 2,700 level, extended to 91-ft. point, vein 4½ ft. wide, carrying quartz and clay seams.

SIERRA NEVADA (Virginia)—East crosscut at 70-ft. point, in 2,500 incline winze, advanced 12 ft., face showing vein matter; winze sunk 4 ft., bottom in vein material.

OPHIR (Virginia)—Main north lateral drift from incline station, 2,500 level, cleaned out and repaired to 530-ft. point. South drift also cleaned out and repaired; north drift from joint west crosscut, 2,700 level, now out 74 ft. with face in quartz of fair assay.

CROWN POINT-BELCHER (Gold Hill)—Repairs made in Jacket 300 level crosscut and 16 cars of ore saved; north drift cleaned out and 91 cars of ore saved; 274 cars saved on 1,600 level. Repairs made on 1,600 station of incline. Jacket mill received 215 tons mine rock, 868 tons dump rock. One bar bullion shipped. Installation of Deister concentrator tables in progress.

UNION CON. (Virginia)—Ore extraction for week: From 2,400 level, 62 tons, $34.70; 71 tons, $48.02; from 2,500 level, 77 tons, $16.20. North drift, 2,700 level, extended 10 ft.; total length in good repair, 360 ft. In Mexican west crosscut at 61-ft. point advanced north drift 6 ft., with face all in quartz of low assay. Union shaft sunk 25 ft., now in good condition to 2,430-ft. point. Repairs made above 2,000 level.

MEXICAN (Virginia)—West crosscut No. 2, 2,500 level, advanced to 360-ft. point, face in porphyry and quartz; north and south drift started on contact. East crosscut No. 4, 2,700 level, in porphyry and quartz at 160-ft. point. East crosscut No. 5 started in drift 406 ft. south of the 2,700-2,900 Mexican winze; face in vein matter of low assay. Mexican mill resumed crushing custom ore after repairs; received 209 tons, average assay $33.71.

SOUTH DAKOTA

Custer County

OLD MIKE (Custer)—Two cars of mica are being forwarded weekly to trimming plant at Crawford, Neb.

CROWN (Custer)—This property of Westinghouse company is being reopened after suspension of four years.

Lawrence County

LEASING IN BALD MOUNTAIN DISTRICT is responsible for much of the activity noted there at present. Golden Reward, Mogul and Ofer companies have been granting leases for some time, and numerous properties held by individuals have been taken over by lessees. At least 40 different blocks are being so worked and 125 to 150 men employed.

HIDDEN TREASURE (Deadwood)—Sinking in progress below 200-ft. level.

WASP NO. 2 (Flatiron)—Has carload tungsten ore and concentrates practically ready to market.

HOMESTAKE (Lead)—Two cars of wolframite ore recently shipped. Tungsten concentrator will probably be ready before end of June.

ECHO (Maitland)—Goulds triplex station pump, with capacity of 125 gal. per min., driven by 15-hp. electric motor, being installed on 200-ft. level. Lateral work to be resumed.

UTAH

Juab County

TINTIC SHIPMENTS for week ended May 12 amounted to 222 cars.

EAGLE & BLUE BELL (Eureka)—Operating new electric compressor and hoist; will greatly increase production.

BECK TUNNEL (Eureka)—Drifting started on the 1,100 level, under contract to Walter Fitch, Jr. On the 900, crosscutting is being done by company.

GOLD CHAIN (Mammoth)—Operating again under favorable conditions; extending tunnel level into unprospected ground. Old workings furnish four to five cars of shipping ore weekly.

EUREKA KING (Eureka)—Organized to develop claims adjoining the Selma and property of the Chief Consolidated in north Tintic; Ray Van Cott, president. Some low-grade ore opened in tunnels. Sinking to 500 level will be undertaken.

Salt Lake County

BONNEVILLE NATURAL GAS AND OIL (Salt Lake)—Company organized to develop oil and natural gas in Utah. Owns large acreage in various parts of the state. D. A. Smith, president; J. B. Taylor, consulting engineer.

CONGOR (Bingham)—Shipments will begin soon from upper workings, idle for years. There is some 3 to 5% copper ore that will net a good profit at present prices. Company working in Montana Bingham tunnel for some months; a raise, starting 100 ft. back of the face of the tunnel (in about 4,048 ft.), is up 400 ft. with 800 ft. more to go to reach old workings.

Summit County

NEW QUINCY (Park City)—Ore encountered in development through 900 level of Daly West; will ship car soon.

DALY WEST (Park City)—Water supply is increasing and mill will soon be in operation. Company will benefit from delay, as since enforced closing, price of silver has risen.

SILVER KING CONSOLIDATED (Park City)—New 50-ton mill will treat material furnished by a second-class dump at the mine and low-grade ore on the 1,800. The machinery, which will be furnished by Traylor Engineering and Manufacturing Co., will be housed in remodeled mill buildings of former Grasselli Chemical Co. plant.

VIRGINIA

Campbell County

OTTER RIVER MINING AND MANGANESE CORPORATION (Evington)—No. 1 shaft down about 92 ft. and will be sunk 65 ft. more. Another shaft soon to be sunk. John W. Woodson, of Lynchburg, president.

CANADA

British Columbia

CANADA COPPER CORPORATION (Greenwood)—Two furnaces now treating about 1,400 tons daily. In Copper Mountain property, 12 mi. from Princeton, 10,000,000 tons of 1.73% copper ore indicated by drilling campaign, now discontinued and supplanted by underground development including 2,000-ft. tunnel; installing 12-mi. power line from Princeton; 2,000-ton flotation mill contemplated. Oscar Lachmund, manager.

Ontario

WEST DOME (Porcupine)—Cut 5 ft. of $18 ore with diamond drill.

VIPOND (Porcupine)—Ore reserves of Mar. 31 were 91,000 tons, averaging $5.24.

DOME EXTENSION (Porcupine)—Let contract for 3,000 ft. of diamond drilling.

DUNCAN SYNDICATE (Larder Lake)—Uncovered vein carrying much free gold.

LA BELLE KIRKLAND (Kirkland Lake)—Shaft down 315 ft. Considering mill installation.

WETTLAUFER (South Lorrain)—High-grade ore extracted from near old working shaft, 130 ft. down.

DAVIDSON (Porcupine)—This mine, now owned by Western syndicate, is being dewatered and will be actively developed.

NIPISSING (Cobalt)—During April, estimated net value of ore mined, $167,446; bullion from Nipissing and custom ores, $447,546.

CROWN RESERVE (Cobalt)—Has relinquished option on Globe mine in California. Recently took option on Cochrane mine in Cobalt and claims in Boston Creek.

MINING CORPORATION OF CANADA (Cobalt)—Second annual report of this company, which owns Cobalt-Townsite, Chambers-Ferland and Cobalt Lake mines, shows output of 4,563,957 oz. silver against 3,185,124 in 1914 and net profits of $1,193,395 as compared with $752,105.

McINTYRE (Porcupine)—Annual report year ended Mar. 31, showed total bullion production, $779,990; disbursements, $447,946; operating profits, $327,524. In regard to recent important discoveries, report says that crosscut on 1,000-ft. level from main working shaft on McIntyre Extension crossed the boundary of the McIntyre, opening large body of high-grade milling ore, partly on property of each company. Developments on upper levels indicate that further orebodies may be cut before crosscut reaches No. 5 shaft.

The Market Report

Metal Markets

NEW YORK—May 24

All of the metals were reactionary during the last week in a dull market. The weakness was most pronounced in the case of spelter.

Copper, Tin, Lead and Zinc

Copper—Scarcely any business was reported by producers and quotations are based chiefly on offerings. The largest producers are sold so well ahead that they are indifferent to the market, but other producers who are not so well sold court further business by offering at concessions, without there being any pressure to sell. The premium on near-by copper has substantially disappeared. There is still a fair quantity of August copper for sale, but producers appear to be most interested in selling for delivery in the last quarter of the year. Prices receded on all deliveries to the extent of about ¾c. per lb., as compared with the end of our last week. In the trade this reaction causes no apprehension, but simply reflects the dullness that has now been prolonged for several weeks. The common opinion is that a renewal of buying demand will put the price back to the 29c. basis, i.e., the terms of the principal producers.

Exports from Baltimore for the week included 3,359,862 lb. copper to France.

Copper Sheets, base price is 37½c. per lb. for hot rolled and 38½c. for cold rolled. Usual extras charged, with higher prices for small quantities. Copper wire is 33½@33¾c. per lb. for large lots at mill.

Visible Stocks of Copper in Europe on May 15 are reported as follows: Great Britain, 2,833; France, 3,700; afloat from Chile, 2,875; afloat from Australia, 4,300; total, 13,708 gross tons, or 30,705,920 lb. This is 2,215 tons less than the May 1 report, the decrease being mainly in copper afloat.

Tin—This market was very dull. In the latter part of the week there was a small recession in price, reflecting the weakness in the London market.

Arrivals of tin at New York for the month up to May 24 were 3,002 gross tons. Tin afloat for New York on May 20 was 3,580 tons.

Corrected reports put the output of tin from the Banka mines in 1915 at 16,200 gross tons, against 15,319 tons in the preceding year.

The corrected statement gives the exports of tin from the Federated Malay States for the two months ended Feb. 29 at 17,243,394 lb., which is 1,089,894 lb. less than last year.

Lead—This market became distinctly weaker, most of the independent producers being willing to shade the price of the A. S. & R. Co. by 10 points or more. In the St. Louis market lead was offered by producers down to 7¼c., while the A. S. & R. Co. maintained its price of 7.42½c. Some speculative lead was offered at lower prices. There was much interest in the trade over a Japanese contract for which tenders were made on May 23, to be decided on May 24. Most of the American producers competed for this order. Some of the large producers report sales for export right along through the week at good prices.

Spelter—Business reported was more than in the previous week, but still continued small in volume. Some producers reported nothing but scattering carload business, while others booked some round lots both for domestic and foreign account. These sales were chiefly for delivery running through the second half of the year. Owing to the great variety of the deliveries for which sales were made the market was difficult to quote. Considering the average, the price faded away gradually. There was a general willingness to sell, without any exhibition of pressure, but signs of the latter became a little more evident. On the other hand there was some reserve displayed by certain smelters who are of the opinion that the market is going to rally, and who are accumulating spelter rather than offering it for sale. Spelter for prompt and early delivery continues scarce on the face of things, but there is some doubt as to whether it is really so scarce as appears. One thing is clear, that the market has been falling of its own weight, there having been no manipulation. There has been a general desire to see how it would behave when left quite to itself.

Imports at Baltimore for the week included 7,500 tons zinc ore from Cartagena, Spain.

Zinc Sheets—The base price was reduced 1c. on May 23 and is now $23.50 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Aluminum—Contract deliveries are easier and comprise most of the business done, as outside metal is rather scarce. Prices are unchanged at 58@60c. per lb. for No. 1 ingots, New York.

DAILY PRICES OF METALS IN NEW YORK

May	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
18	4.7613	75¼	28¼ @29	49	7.45 @7.50	7.30 7.42½	13.25 @14.25
19	4.7534	75¼	28¼ @28¼	49	7.40 @7.50	7.25 @7.42½	13.00 @14.00
20	4.7600	75¼	28¼ @28¼	49	7.40 @7.50	7.25 @7.42½	13.00 @14.00
22	4.7588	71¼	28¼ @28¼	48¼	7.40 @7.50	7.25 @7.42½	12.75 @13.75
23	4.7575	71⅛	28 @28¼	48	7.40 @7.50	7.25 @7.42½	12.75 @13.75
24	4.7569	71⅛	28 @28¼	48	7.40 @7.50	7.25 @7.42½	12.50 @13.50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts,etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

May	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
18	36¼	143	141	158	33.62	197½	197⅛	31⅛	6.72	95	20.19
19	36⅛	138	136	158	33.62	197⅛	197⅛	31⅛	6.68	95	20.19
20	36	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	34	137	134	158	33.62	196	196¼	31⅛	6.72	95	20.19
23	34⅛	136	133	158	33.62	193	193¼	31⅛	6.68	95	20.19
24	34 7/16	132	130⅛	158	33.62	192	192¼	31⅛	6.68	95	20.19

The above table gives the closing quotations on London Metal Exchange, All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—May 24

Antimony—The market continues practically nil with prices much softer on small business. Spot is quoted at 28@29c. per lb. Shipment from China within one month is quoted at 24@25c. per lb., c.i.f., New York, duty unpaid.

Quicksilver—The market is again lower and is at present rather unsettled, chiefly owing to offers of some lots recently from Mexico or South America. New York quotations may be put at $82@85 per flask of 75 lb. Sales have improved a little. San Francisco reports $85@90 per flask on a quiet market. The London price remains £16 10s. per flask. The London and New York prices are now about on a parity.

Nickel—The market is rather active with a good demand for export in addition to domestic requirements. Quotations are steady at 45@50c. per lb. for ordinary forms; with 5c. additional for electrolytic nickel.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.25 per lb., New York. The London price is 11s. per lb.—**Cadmium** is quoted at $1.25@1.50 per lb.—**Cobalt** is $1.25 per lb.—**Magnesium** is quoted at $5.50 per lb. for 99% pure.—**Selenium** is from $3 up to $5 per lb., according to quantities.

Gold, Silver and Platinum

NEW YORK—May 24

Gold Receipts from Canada last week were $4,000,000, making the total brought to New York from that country $12,450,000 on the recent movement.

Gold Exports from San Francisco for the four months ended Apr. 30 were $14,470,272; imports, $7,965,225; excess of exports, $6,505,047. Silver exports for the four months were valued at $3,939,075; imports, $825,959; excess of exports, $3,113,116. Of the silver exports $33,250 were in coin and $3,079,866 in bullion.

Japan's Gold Holdings at the end of April, according to a report from the Ministry of Finance amounted to $254,235,000, of which $194,415,000 is owned by the Bank of Japan, while $59,820,000 is due the Imperial Treasury. The bulk of this amount is kept abroad. The Bank of Japan holds only $84,745,000. There is $19,940,000 on deposit in New York. The funds in the Treasury vaults are estimated at $47,856,000, a gain of $24,925,000 over last year. The large increase in gold holdings is said to be due to receipts from the sale of munitions and to the heavy expansion in the foreign trade of the country.

Platinum—The market is still very quiet and sales have been small. The price remains unchanged, at about $80 per oz. for refined platinum and $4 or $5 higher for hard metal.

Silver has had a sharp reaction from 36¼ to 34d.—caused by realizations on holdings (so far as the information can be obtained), of India operators. Market is steady at the decline and as the underlying conditions are unchanged it is probable. Some improvement in price may be looked for in the near future.

The Government of Colombia has arranged to buy in New York sufficient silver for 1,000,000 fifty-cent pieces. The coinage will be done at the United States Mint in Philadelphia.

A despatch from Manila, May 23, says that the Philippine Government has sold to the Indian Government 7,500,000 silver pesos, at a price not stated. The Philippine peso has a face value of 50c. gold.

Zinc and Lead Ore Markets

JOPLIN, MO.—May 20

Blende, high price $102.30; per ton 60% zinc, premium ore, $100; medium grades $90@80 and lower grades down to $70; calamine, per ton 40% zinc, $60@50; average selling price, all grades of zinc, $88.88 per ton. Lead, high price $98.70; per ton 80% metal content, $96@95; average, all grades of lead ore, $95.94 per ton.

SHIPMENTS WEEK ENDED MAY 20

	Blende	Calamine	Lead	Values
Totals this week	9,048,340	70,640	2,051,670	$503,610
Totals this year.	284,234,400	24,150,040	47,888,050	18,679,460

Blende value, the week, $403,110; 20 weeks, $15,585,470.

Calamine value, the week, $2,100; 20 weeks, $907,220.

Lead value, the week, $98,400; 20 weeks, $2,186,170.

A large proportion of this week's shipment was purchased around a $90 base, but buying yesterday and today for future delivery, is around $80@85 base. There is some evidence this evening of a slightly increasing demand for blende, with the demand for calamine nil. The estimate of 4,500 tons purchased last week is checked with a shipment of 4,559 tons this week. Shipments of ore have begun to the Picher Lead Co.'s new smeltery at Henryetta, Okla. The continued decline in ore prices will result in a sharp reduction in the wage scale next month, and some fears of trouble are entertained.

PLATTEVILLE, WIS.—May 13

The base price paid this week for zinc ore was $90 per ton for top grades down to $80 per ton base for medium grades assaying down to 52%, all sold on an assay basis of 60% metallic zinc. The base price paid for 80% lead ore was $90@

SHIPMENTS WEEK ENDED MAY 20

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	5,416,000	143,600	950,100
Year	88,464,000	3,000,930	25,073,300

Shipped during week to separating plants, 5,834,000 lb. zinc ore.

OTHER ORES

Manganese Ore—Prices are still strong. Brazilian ore is quoted at 70@75c. per unit at seaboard ports. There is very little Indian ore to be had, and about 85c. per unit is asked for small lots.

Arrivals at Baltimore for the past two weeks included 35,500 tons from Rio Janeiro, Brazil; 7,350 tons from Cuba; 1,300 tons from India; a total of 55,550 tons manganese ore.

Antimony Ore maintains its quotation at $2.50 per unit from which figure reductions are not expected on account of the continuing high ocean freight rates.

Tungsten Ore shows no material change from last week. Offers are made at $40@45 per unit for both spot and future deliveries, but sellers are not disposed to accept these low prices. It is believed that the decline will affect supplies and a scarcity may restore the market.

Iron Trade Review

NEW YORK—May 24

Just at present the larger share of the new business seems to be coming in on the export side. Heavy orders are reported for shells for delivery through the balance of the year, and for steel billets for delivery abroad, especially to France and Italy. Domestic orders have been comparatively light, though not by any means absent.

High prices seem to be having an effect on structural steel and fabricators are holding back. Outside of some new subway contracts in New York, there is less work on the market than for some weeks past. Some large contracts appear to be held back, partly on account of prices and partly by uncertainties as to deliveries.

Pig iron has been quiet. There has been a good inquiry for iron in Seaboard territory, but only moderate buying in the West.

Bids received for steel required for the new subways in New York varied considerably in amount. For riveted steel the range was from $93 to $120 per ton; for beams and shapes, $82 to $110 per ton.

Exports from Baltimore for the week included 5,723,514 lb. steel billets, 9,273,488 lb. steel rails and 360,525 lb. rail joints to France; 1,880 tons pig iron and 1,916 tons steel billets to Italy; 695,900 lb. steel rails, 85,595 lb. rail fastenings and 1,568,000 lb. pig iron to Chile; 4,934,261 lb. miscellaneous iron and steel to Cuba.

Exports of Iron and Steel and products thereof from the United States in March reached a total value of $58,300,297, which compares with $20,551,137 for March, 1915. The tonnage, so far as reported, was 438,150, against 174,169 last year. The exports for the three months ended Mar. 31 were as follows, tonnage of those exports which are reported by weight being given in gross tons:

	1915	1916	Changes
Tonnage exports	457,611	1,184,091	I. 726,480
Machinery, value	$25,666,783	$44,513,754	I.$18,846,971
Total value	97,507,107	228,433,621	I.130,926,514

The total increase this year was 134.3%. Imports so far as reported by weight were 8,054 tons in March, 1915, and 15,158 in 1916; increase, 7,104 tons.

PITTSBURGH—May 23

The steel situation continues very strong. Outside of orders for war steel there is very little strictly new business being placed, buyers having covered their prospective requirements for a long time ahead, by contracts, while new projects are coming up less frequently, on account of high costs and labor scarcity. There has been a decrease in specifications against contracts, but the specifications are still running somewhat ahead of shipments. In the first three months of the year specifications piled up rapidly. Since the first of this month contract obligations on books have decreased, but the volume of actual shipping orders, including specifications against contracts, has increased.

The Steel Corporation has just booked a large tonnage of shell steel, estimated at between 200,000 and 300,000 tons. In the past three weeks independents have booked a large aggregate of war steel and the total war steel placed since the first of the month probably exceeds half a million tons. There is still some inquiry for shell steel, while there is large inquiry for barb wire. The shell steel has been almost exclusively for this year's delivery, but barb wire will be taken for 1917 delivery.

Labor conditions have become much quieter, and mills have much less apprehension than a fortnight or a month ago. Warmer weather will curtail output somewhat, but the mills expect heavy production and shipments throughout the year. Only a very small volume of additional business would serve to operate them at capacity into 1917.

Steel prices are practically stationary and large advances are hardly expected for the future, while on the other hand it is not expected there will be any general revision downward until the great mass of orders now in hand is filled.

Pig Iron—It is stated that some sales of basic at $18.25, Valley, have stiffened the market so that the next important sales may be at $18.50. Despite occasional lots of resale foundry offered at cut prices, on account of the strike of molders, the furnaces are holding firm at their former quotation of $18.50. The market as a whole is very quiet but shows a decided undertone of strength in the circumstances. We quote: Bessemer, $21@21.50; basic, $18.25@18.50; foundry, $18.50@18.75; malleable, $18.25@18.75; forge, $18@18.25, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The recent large sales of shell steel in the form of billets and large rounds have not stiffened the ordinary billet market materially, since the indisposition of mills to sell soft steel has been due to their holding capacity in reserve for any war orders that might be offered, the war steel being so profitable that no chances are being taken of being unduly loaded with orders for ordinary billets. Sales of soft-steel billets in the past fortnight have been chiefly of odd lots accumulated, or against rolling capacity open for a few weeks, no extended contracts being accepted. Sales have been chiefly at $42@45 for bessemer or openhearth billets, sheet bars being held at the same range, but with no buyers. Forging billets are $65@70, with occasional odd lots offered at less. Rods range from $55 to $60, according to circumstances as to tonnage, delivery and analysis. The soft-steel market is a shade easier than a month ago, but appears to be a trifle firmer than a week ago.

FERROALLOYS

Ferromanganese—The market for spot ferromanganese has been very quiet for several weeks, the rush being over. Prices for spot are easier, at $325@350, but still extremely high compared with the contract price, which remains at $175, with deliveries offered for first and second half of 1917, production for this year being quite well sold out.

Arrivals of ferromanganese from Baltimore for two weeks past were 1,024 tons from Liverpool.

The Seaboard Steel and Manganese Co., No. 5 Wall Street, New York, has acquired Temple Furnace at Temple, Penn., and will run it on ferromanganese, using ore from Elkton, Va. Hartley C. Wolle, formerly with the Cambria Steel Co., is president.

Ferrosilicon is unchanged, but pressure for early deliveries is easing up, as supplies are gradually increasing.

Spiegeleisen is in demand still and 20 to 25% alloy for early delivery is held at $70@75 per ton, delivered.

FOREIGN IRON

Pig-Iron Production in Germany in March was 1,114,194 metric tons, being 77,571 tons more than in February and 175,756 tons more than in March, 1915. For the three months ended Mar. 31, the total make was 3,229,245 tons, which compares with 2,616,194 tons in 1913 and 4,614,912 tons in 1914, before the war.

IRON ORE

A corrected statement of iron-ore shipments from the Lake Superior district in April, the first month of navigation, gives the figures by ports as below in gross tons:

Port.	1915	1916	Changes
Escanaba	49,307	398,214	I. 348,907
Marquette	4,438	53,258	I. 48,820
Ashland	43,949	147,852	I. 103,903
Superior	87,175	211,340	I. 124,165
Duluth	174,989	538,281	I. 363,292
Two Harbors	143,974	309,466	I. 165,492
Total	503,832	1,658,411	I. 1,154,579

Of the total this year 409,200 tons went to Lake Erie ports. Total ore reported on Lake Erie docks May 1 was 3,343,405 tons, against 6,092,303 tons in 1915. The total on dock Dec. 1, 1915, was 8,910,551 tons. The total shipments by rail to furnaces, winter of 1915-1916 were therefore 5,566,946 tons. Adding these winter shipments to 35,149,412 tons, the amount shipped to furnaces during the navigation season of 1915, gives 40,716,358 tons as the entire shipment of ore from Lake Erie ports to furnaces during the year ending May 1, as against 25,230,489 tons for the year ending May 1, 1915.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 440,678 net tons; shipments, 440,077 tons. Shipments of Greensburg and upper Connellsville districts, 36,367 tons.

Coal production of the Dutch government mines of Ombilien and Poeloe Laoet in Sumatra in 1915 was 555,295 metric tons, an increase of 4,007 tons over the previous year.

Connellsville—The market is extremely quiet at all points. Some producers have been endeavoring to encourage restriction of production, but without great success. There is only occasional demand for spot, while the few consumers uncovered for second half are biding their time. We quote: Spot furnace, $2.25@2.40; contract, nominal, $2.50@3; spot foundry, $3.50@3.75; contract, $3.50, per net ton at ovens.

Anthracite Shipments in April were 4,528,784 gross tons, a decrease of 2,126,841 tons, as compared with April, 1915. For the four months ended Apr. 30 the total shipments were 20,914,432 tons in 1915, and 22,236,791 in 1916; an increase of 1,322,359 tons this year.

Fuel Exports and Imports in the United States, two months ended Feb. 29, as reported by the Department of Commerce in long tons:

	Exports		Imports	
	1915	1916	1915	1916
Anthracite	368,539	568,527	11	4,375
Bituminous	1,218,033	1,984,064	252,997	315,007
Coke	101,756	179,005	6,718	10,101
Bunker coal	1,030,867	1,106,974	.....	.....
Total	2,719,195	3,838,570	259,726	329,483

The bunker coal or coal supplied to ships in foreign trade is practically all bituminous. The principal trade is with Canada, and showed large gains in exports this year. Outside of that country the notable increase was to Italy, which took 261,653 tons this year against 88,622 last year.

Chemicals

NEW YORK—May 24

The general market has been rather quiet and prices have been rather easier.

London despatches to the New York "Journal of Commerce" report that a working agreement has been arranged between Brunner, Mond & Co. and the Castner-Kellner Alkali Co. The merger is planned for the purpose of extending the British foreign trade in chemicals, to prevent competition in foreign markets between these large concerns and to seek the trade in England of manufacturers who have heretofore relied largely on the products of German manufacture. It is understood that Brunner, Mond & Co. are allotting 200,000 shares, estimated to be worth £800,000, to the Castner-Kellner Alkali Co., which will allot 250,000 shares valued at £850,000 to Brunner, Mond & Co. An interchange of directors has also been arranged, by which many members will act on the boards of both companies.

Copper Sulphate—Export demands have been satisfied for the present, and business has been quiet. Prices are easier, $18@19 per 100 lb. being asked for large lots.

Nitrate of Soda—April production of nitrate in Chile is reported at 243,000 tons; shipments, 219,500 tons. Supplies here are good and prices a little easier at $3.10 per 100 lb. for spot and $3 for futures.

Pyrites—Arrivals at Baltimore for two weeks past included 15,431 tons iron pyrites from Huelva, Spain.

Sulphur—Shipments are still quoted at $30 per ton, New York. Spot supplies are rather scarce and premiums are asked for immediate delivery.

PETROLEUM

Exports of petroleum from Rumania, which were 1,036,446 metric tons in 1913, fell to 654,024 tons in 1914, and to 429,087 tons in 1915. Nearly 90% of the exports in 1915 went to Austria and Germany.

Exports of mineral oils from the United States in March were 218,019,240 gal., an increase of 50,866,546 gal. over March, 1915. For the three months ended Mar. 31 the exports were 465,189,418 gal. in 1915, and 569,254,805 gal. in 1916; an increase of 104,065,387 gal., or 22.4%, this year.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Mont.	June 15	July 15	$0.005
Algomah, Mich.	May 18	.....	1.00
Alpha, Nev.	June 7	June 28	0.03
Andes, Nev.	May 9	May 31	0.02
Best & Belcher, Nev.	June 9	June 28	0.05
Challenge, Nev.	June 12	July 7	0.05
Coeur d'Alene Antimony, Ida.	June 3	.....	0.01
Con. Virginia, Nev.	May 19	June 9	0.05
Diam'dfield Black Butte, Nev.	Apr. 12	May 18	0.01
East Hercules, Ida.	May 1	July 3	0.0015
Emerald, Utah.	May 15	June 10	0.0033
Emerald, Utah.	June 15	July 8	0.0033
Enterprise, Ida.	May 20	June 20	0.001
Federal Ely, Nev.	May 1	June 4	0.005
Four Timbers, Ida.	May 5	June 5	0.001
Friend, Ida.	Apr. 28	May 20	0.002
Goldstrike Bon., Utah.	June 15	July 15	0.01
Howell, Utah.	Apr. 15	June 3	0.01
Idaho & Los Angeles, Ida.	June 2	July 1	0.005
Kewanas, Nev.	May 1	June 5	0.01
McKinley, Utah.	May 22	June 15	0.0025
National, Ida.	June 2	July 3	0.02
Nine Mile, Idaho.	May 12	June 1	0.0015
Old Veteran, Ida.	May 6	June 3	0.02
Overman, Nev.	May 3	May 23	0.05
Phedora, Ida.	May 9	July 1	0.005
Rhode Island, Ida.	Mar. 30	May 15	0.002
Rio Grande, Nev.	May 22	July 22	0.002
Rob Roy, Ida.	June 10	July 10	0.002
Roosevelt, Utah.	June 1	July 1	0.02
Sierra Nevada, Nev.	May 5	May 25	0.05
Silver Cable, Ida.	May 22	June 10	0.005
Silver Star, Ida.	June 14	July 1	0.002
Smuggler, Utah.	May 15	June 1	0.0025
Snowstorm Ext., Idaho.	May 9	June 13	0.003
Sonora, Ida.	June 5	June 30	0.004
Spider, Utah.	Apr. 26	May 15	0.005
Sunset, Ida.	June 3	June 24	0.002
Tarbox, Ida.	May 6	June 20	0.05
Tiberius, Ida.	Apr. 15	May 15	0.001
Umatilla, Nev.	Apr. 17	May 22	0.005
Utah-Arizona, Ariz.	Apr. 14	May 16	0.0025
Uvada, Nev.	June 24	July 27	0.02
Western Pacific, Utah.	May 16	June 6	0.00½
Zuma, Utah.	Apr. 24	May 15	0.0025

Stock Quotations

SAN FRANCISCO May 23	
Name of Comp.	Bid.
Alta.	.04
Andes.	.08
Best & Belcher.	.02
Bullion.	.01
Caledonia.	.37
Challenge Con.	.05
Confidence.	‡.15
Cons. Imperial.	.01
Con. Virginia.	.17
Gould & Curry.	.02
Hale & Norcross.	.04
Jacket-Cr. Pt.	.12
Mexican.	.17
Occidental.	.70
Ophir.	.24
Overman.	‡.06
Savage.	.03
Seg Belcher.	.02
Sierra Nevada.	.34
Union Con.	.67
Utah Con.	.01
Belmont.	4.75
Jim Butler.	.98
MacNamara.	.11
Midway.	.25
Mont.-Tonopah.	.32
North Star.	.17
Rescue Eula.	.49
West End Con.	1.15
Atlanta.	.12
Blue Bell.	.02
Booth.	.20
C.O.D. Con.	.03
Comb. Frac.	.10
D'field Daisy.	.03
Jumbo Extension.	.90
Pitts.-Silver Peak.	.06
Round Mountain.	.73
Sandstorm Kendall.	.05
Silver Pick.	.07
Central Eureka.	.06
Argo.	.20
Big Jim.	1.25
Lazy Boy.	.20
Oatman Cres.	.42
Oatman No. Star.	.20
Tom Reed.	1.70
United Eastern.	4.50
United Western.	.25

LONDON	May 10
Alaska Tre'dwell	£6 10s 0d
Burma Corp.	2 9 0
Cam & Motor.	0 15 7½
Camp Bird.	0 10 0
El Oro.	0 10 9
Esperanza.	0 11 9
Mexico Mines.	4 2 6
Nechi, pfd.	0 14 3
Oroville.	0 16 6
Santa Gert'dis.	0 14 6
Tomboy.	1 3 9
Tough Oakes.	‡0 11 3

SALT LAKE May 23	
Name of Comp.	Bid.
Beck Tunnel.	‡.22½
Black Jack.	.12
Colorado Mining.	.21
Crown Point.	.06
Daly-Judge.	8.00
Emma Cop.	.69
Gold Chain.	.30
Grand Central.	.74
Iron Blossom.	1.92½
Lower Mammoth.	.06
May Day.	.14
Opohongo.	‡.02½
Prince Con.	1.42½
Seven Troughs.	‡.02
Silver King Coal'n.	2.90
Silver King Con.	3.22½
Sioux Con.	.16½
Uncle Sam.	.09½
Yankee.	.34

COLO. SPRINGS May 23	
Acacia.	.03½
Cripple Cr'k Con.	‡.00½
Doctor Jack Pot.	.10½
Elkton Con.	.22½
El Paso.	.76
Findlay.	.04½
Gold Sovereign.	.03½
Golden Cycle.	2.17½
Granite.	.69½
Isabella.	.19½
Jack Pot.	.06
Jerry Johnson.	.04½
Mary McKinney.	.42
Portland.	1.76
Vindicator.	2.40

TORONTO May 23	
Bailey.	.09
Chambers Ferland.	.28
Coniagas.	5.00
La Rose.	.62½
Peterson Lake.	.28
Right of Way.	.04
Seneca Superior.	.50
T. & Hudson Bay.	‡33.00
Temiskaming.	.67
Trethewey.	.28
Wettlaufer-Lor.	.06
Dome Exten.	.34
Dome Lake.	.27
Foley O'Brien.	.45
Hollinger.	29.50
Imperial.	‡.03½
Jupiter.	.35
McIntyre.	1.93½
Porcu. Crown.	.62½
Preston E. D.	.04
Vipond.	.58
West Dome.	.34

N. Y. EXCH. May 23	
Name of Comp.	Clg.
Alaska Gold M.	22½
Alask a Juneau.	8½
Am.Sm.&Ref.,com.	101
Am. Sm. & Ref., pf.	113½
Am. Sm. Sec., pf. A	94½
Am. Sm. Sec., pf. B.	86½
Am. Zinc.	87½
Anaconda.	85⅛
Batopilas Min.	2½
Bethlehem Steel.	439½
Bethlehem Steel, pf.	135
Butte & Superior.	95
Chile Cop.	21½
Chino.	53½
Colo. Fuel & Iron.	44
Crucible Steel.	83½
Dome Mines.	26
Federal M. & S.	18½
Federal M. & S., pf.	38
Great Nor., ore ctf.	41
Greene Cananea.	47½
Homestake.	129
Inspiration Con.	45½
International Nickel	45½
Kennecott.	55½
Lackawanna Steel.	71
Miami Copper.	36½
Nat'l Lead, com.	67
National Lead, pf.	115½
Nev. Consol.	17½
Ontario Min.	9
Quicksilver.	2½
Quicksilver, pf.	3½
Ray Con.	23⅜
Republic I&S, com.	47½
Republic I&S, pf.	111⅛
Sloss-Sheffield.	54
Sloss-Sheffield, pf.	92
Tennessee Copper.	46
Utah Copper.	80½
U. S. Steel, com.	84⅛
U. S. Steel, pf.	117
Va. Iron C. & C.	50

N. Y. CURB May 23	
Adanac.	.65
Alta Con.	.60
Beaver Con.	.43
Buffalo Mines.	1⅛
Butte & N. Y.	3
Butte C. & Z.	7½
Can. Cop. Corpn.	2 1/16
Cashboy.	.08½
Cerro de Pasco.	38
Con. Ariz. Sm.	1 1/16
Con. Coppermines.	2⅛
Con. Nev.-Utah.	⅛
Dia. Black B.	.06
First Nat. Cop.	5⅛
Florence.	.48
Goldfield Con.	.94
Goldfield Merger.	.12
Granite.	.48
Hecla Min.	4 1/16
Howe Sound	5⅛
Jerome Verde.	2 1/16
Kenefick Zinc.	14½
Kerr Lake.	4 1/16
Magma.	16½
Majestic.	⅛
McKinley-Dar-Sa.	.62
Mines of Am.	2½
Mother Lode.	.32½
Nevada Hills.	.22
New Utah Bingham	‡2½
Nipissing Mines.	7⅛
Oro.	.05
Ray Hercules.	4⅛
Rochester Mines.	.73
St. Joseph Lead.	16½
Standard S. L.	1⅛
Stewart.	1/16
Success.	.78
Tonopah.	6½
Tonopah Ex.	6 1/16
Tribullion.	⅛
White Knob, pf.	1⅛
Yukon Gold.	2½

BOSTON EXCH May 23	
Name of Comp.	Bid
Adventure.	3¼
Ahmeek.	400
Algomah.	1¾
Allouez.	69
Ariz. Com., ctfs.	8½
Bonanza.	‡.37
Butte-Ballaklava.	2 1/16
Calumet & Ariz.	75
Calumet & Hecla.	574
Centennial.	16
Copper Range.	67½
Daly West.	3½
East Butte.	12½
Franklin.	8½
Granby.	88
Hancock.	14½
Hedley.	‡20
Helvetia.	.35
Indiana.	3½
Island Cr'k, com.	50½
Island Cr'k, pfd.	92
Isle Royale.	29
Keweenaw.	5½
Lake.	16½
La Salle.	4½
Mason Valley.	3⅜
Mass.	12½
Mayflower.	3
Michigan.	3½
Mohawk.	96½
New Arcadian.	7
New Idria.	14
North Butte.	25
North Lake.	1½
Ojibway.	2
Old Colony.	2½
Old Dominion.	70
Osceola.	96
Quincy.	97
St. Mary's M. L.	76
Santa Fe.	2½
Shannon.	8½
Shattuck-Ariz.	32
So. Lake.	7½
So. Utah.	.30
Superior.	16½
Superior & Bost.	4½
Tamarack.	52
Trinity.	7
Tuolumne.	.42
U. S. Smelting.	75½
U. S. Smelt'g, pf.	51½
Utah Apex.	4 1/16
Utah Con.	14
Utah Metal.	‡9½
Victoria.	3½
Winona.	5½
Wolverine.	57
Wyandot.	1½

BOSTON CURB May 23	
Bingham Mines.	14¾
Boston Ely.	.50
Boston & Mont.	1⅛
Butte & Lon'n Dev.	.75
Calaveras.	4½
Calumet-Corbin.	.05
Chief Con.	2
Cortez.	.60
Crown Reserve.	.58
Davis-Daly	1⅛
Eagle & Blue Bell.	2⅛
Houghton Copper.	1½
Iron Cap Cop., pf.	6½
Mexican Metals.	.38
Mojave Tungsten.	6½
Nat. Zinc & Lead.	2
Nevada-Douglas.	.99
New Baltic.	2½
New Cornelia.	14½
Ohio Copper.	.18
Oneco.	1
Raven Copper.	.18
Rex Cons.	.29
Rilla.	.75
United Verde Ext.	26½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January.	56.572	48.855	56.775	26.553	22.731	26.960
February.	57.506	48.477	56.755	26.573	22.753	26.975
March.	58.067	50.241	57.935	26.788	23.708	27.597
April.	58.519	50.250	64.415	26.958	23.709	30.662
May.	58.175	49.915	.....	26.704	23.570	.....
June.	56.471	49.034	.....	25.948	23.267	.....
July.	54.678	47.519	.....	25.219	22.597	.....
August.	54.344	47.163	.....	25.979	22.780	.....
September.	53.290	48.680	.....	24.260	23.591	.....
October.	50.654	49.385	.....	23.199	23.925	.....
November.	49.082	51.714	.....	22.703	25.094	.....
December.	49.375	54.971	.....	22.900	26.373	.....
Year.	54.811	49.694	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.758	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April.	16.811	27.895	75.096	124.319	*	137.389
May.	18.506	.....	77.600	.....	*	.....
June.	19.477	.....	82.574	.....	95.333	.....
July.	18.796	.....	76.011	.....	91.409	.....
Aug.	16.941	.....	68.673	.....	82.333	.....
Sept.	17.502	.....	68.915	.....	85.250	.....
Oct.	17.686	.....	72.601	.....	88.000	.....
Nov.	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.43	.....
Year.	17.275	.....	72.532	.....	.....	.....

TIN

Month	New York		London	
	1915	1916	1915	1916
January.	34.260	41.825	156.550	175.548
February.	37.415	42.717	176.925	181.107
March.	48.426	50.741	180.141	193.609
April.	47.884	51.230	166.225	199.736
May.	38.790	.....	162.675	.....
June.	40.288	.....	167.636	.....
July.	37.423	.....	167.080	.....
August.	34.389	.....	151.440	.....
September.	33.125	.....	152.625	.....
October.	33.080	.....	151.554	.....
November.	39.224	.....	167.670	.....
December.	38.779	.....	167.000	.....
Av. year.	38.590	.....	163.960	.....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January.	3.729	5.921	3.548	5.826	18.606	31.167
February.	3.827	6.246	3.718	6.164	19.122	31.988
March.	4.053	7.136	3.997	7.375	21.883	34.440
April.	4.221	7.630	4.142	7.655	21.094	34.368
May.	4.274	.....	4.182	.....	20.347	.....
June.	5.932	.....	5.836	.....	25.170	.....
July.	5.659	.....	5.531	.....	24.611	.....
August.	4.656	.....	4.520	.....	21.946	.....
September.	4.610	.....	4.490	.....	23.151	.....
October.	4.600	.....	4.499	.....	23.994	.....
November.	5.155	.....	5.078	.....	26.278	.....
December.	5.355	.....	5.266	.....	28.807	.....
Year.	4.673	.....	4.567	.....	22.917	.....

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April.	10.012	16.695	9.837	16.525	49.888	99.056
May.	14.781	.....	14.610	.....	68.100	.....
June.	21.208	.....	21.038	.....	100.614	.....
July.	19.026	.....	18.856	.....	97.250	.....
Aug.	12.781	.....	12.611	.....	67.786	.....
Sept.	13.440	.....	13.270	.....	67.841	.....
Oct.	12.800	.....	12.596	.....	66.536	.....
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year.	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton. * Not reported

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January.	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February.	14.55	21.16	13.45	18.93	13.90	19.51
March.	14.55	21.81	13.45	19.20	13.95	19.45
April.	14.55	21.65	13.45	18.95	13.95	19.45
May.	14.61	.....	13.60	.....	13.83	.....
June.	14.70	.....	13.67	.....	13.77	.....
July.	14.94	.....	13.91	.....	13.68	.....
August.	16.01	.....	15.31	.....	14.75	.....
September.	16.86	.....	15.95	.....	15.70	.....
October.	16.95	.....	15.96	.....	15.80	.....
November.	17 57	.....	16.47	.....	17.20	.....
December.	19.97	.....	18.44	.....	18.95	.....
Year.	$15.82	.....	$14.76	.....	$14.95	.....

‡As reported by W. P. Snyder & Co.